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Effect of Mechanical Traction Versus Kaltenborn Traction with Mobilization on Post Operative Knee Stiffness

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ABSTRACT

Background: Knee stiffness is the most common musculoskeletal disorder. Manual traction is effective in treating post operative knee stiffness but it has limitations which may be overcome by using Mechanical traction. However there is limited research available to show any significant impact of mechanical traction with mobilization on post operative knee stiffness.

Aim: The purpose of this study was to find effect of mechanical traction versus Kaltenborn traction with mobilization on post operative knee stiffness.

Study Design: The study design was Pre test-Post test single blinded study.

Method and Material: 30 subjects (17 males/13 females, age 25-65) were randomly allocated in 2 groups. Group (A) received mechanical traction with mobilization, hot moist pack, CPM and exercises. Group (B) received Kaltenborn traction with mobilization, hot moist pack, CPM and exercises. Both the groups received treatment for 6 sessions/wk for 4 wks. Pre-Post score was assessed using WOMAC, range of motion (ROM) and visual analogue scale (VAS).

Statistical Analysis: The data was analyzed with INSTAT software using paired and unpaired t test.

Results: Both the groups showed improvement but there was extremely significant improvement in WOMAC scale (p<0.001), ROM (p<0.001) and VAS (p<0.001) in group treated with the mechanical traction with mobilization. This data indicates that mechanical traction gives better result than the manual traction.

Conclusions: Mechanical Traction with mobilization was more effective in decreasing pain and improving quality of life in post operative knee stiffness than using conventional therapy alone.

Keywords: Mechanical traction, manual traction, continuous passive motion, hot moist pack, WOMAC scale, range of motion, visual analogue scale.

Introduction

Knee stiffness is a symptomatic loss of knee extension or flexion compared to the opposite normal knee. Stiffness of the knee is a common complication that can lead to loss of knee range of motion, loss of strength, pain and inability to return to previous levels of activity. It is a limitation in range of motion, it is a potential complication after any post operative intraarticular or extraarticular trauma. Knee stiffness is one such complaint that needs proper evaluation after any trauma. Prevalence rate for post operative knee stiffness is 11%.

Intra articular stiffness can be occur due to presence of dense intra articular adhesion, excessive proliferation of fibrous scar tissue, retraction of periarticular soft tissue and bone impingement due to intra articular malunion. Likewise, extra articular stiffness can be occur due to quadriceps adhesion to a femoral callus, retraction of the muscle due to scar tissue so that knee
stiffness starts. When there is immobilization of knee for several weeks or longer, such as during healing of a fracture or after surgery, the capsule, muscle, and soft tissue develops contractures, which leads to contractures in motion. It may restrict downward gliding of the patella, which limits knee flexion, and may cause pain as the patella is compressed against the femur. The treatment of knee stiffness is currently limited to application of hot fomentation, ultrasound, manual mobilization, Continuous passive motion and exercises. Hot moist pack (20min.), Ultrasound(0.2w/cm² for 10 min.), Continuous passive motion(20min.), Manual traction with mobilization technique. Hot moist packs are applied to the injured body part in the several layers of towels. It gives for 20min. It relaxes the tight muscles causing tissues to relax as well as also decreases pain caused by muscle tension or spasm. Traction is the technique of applying a distracting force to produce either a realignment of a structural abnormality or to relieve abnormal pressure on nociceptive receptor systems. The amount of weight to be used depends on the fracture but generally weight between 1/10 and 1/7 of the body is safe and adequate for most fractures.

It is found in earlier studies that manual traction is effective in treating post operative knee stiffness. But manual mobilization has limitations like: limited maximum traction force, amount of force can’t be easily replicated or specifically recorded, can’t be applied for prolonged period of time and requires a skilled clinician. By using mechanical traction the force and time can be well controlled, readily graded and replicable. However there is limited research available to show any significant impact of Mechanical Traction with mobilization versus Kaltenborn traction with mobilization in post operative knee stiffness.

Materials & Method

Ethical clearance was obtained. Informed written consent was taken. The study was single blinded experimental study. 30 subjects (17 males, 13 females) with postoperative knee stiffness were allocated into 2 groups using convenient sampling with random allocation method. Inclusion criteria were subjects indicated for manual knee joint mobilization. Exclusion criteria was an intra articular fractures, joint infection, osteoporosis, fixed lower limb deformity, malignancy, recent soft tissue injury, open wound or skin disease. Outcome measures like WOMAC Scale, VAS, and ROM were used to assess pre treatment and post treatment. Group (A) (n=15) received mechanical traction with mobilization, hot moist pack, CPM and exercises. Group (B) (n=15) received Kaltenborn traction with mobilization, hot moist pack, CPM and exercises. Both the groups received treatment for 6 sessions/wk for 4 wks. The baseline treatment for both groups was Hot moist pack for 20 min., Continuous passive motion(30min.), Static exercises(10rep), Active knee exercise(10rep), VMO strengthening, Quadriceps table(10rep).

Group (A) subjects were received Mechanical traction with mobilization with the help of traction frame (Mechanical traction 1/7 of the body weight, Intermittent Traction- for 30 sec hold followed by 10 sec rest period), for total of 7 min traction for 6 treatment sessions per wk for 4 wks.

Group (B) subjects were received Kaltenborn traction with mobilization.

Analyses were performed using INSTAT statistical software. Intra Group comparison (within Group) was analyzed statistically using Paired t test, inter Group comparison (between Group) was analyzed statistically using Unpaired t test.

Results

Total 30 subjects were taken for study. The gender ratio of Group A was 9:6(9 males and 6 females) and Group B was 8:7 (8 males and 7 females) and was statistically not significant. Therefore both groups matched with respect to gender.

The age of participants ranged from 25-65. The mean age of participants in group A was 42 years ± 8.44 and mean age of participants in group B was 44.93 years ± 12.8. The difference in mean age of two groups was statistically not significant (p = 5.11). Therefore both the groups matched with respect to age.
### Table 1: WOMAC Score

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-interventional Mean ± SD</th>
<th>Post-Interventional Mean ± SD</th>
<th>P values</th>
<th>t-value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group(A)</td>
<td>33.8 ± 5.57</td>
<td>8.53 ± 3.24</td>
<td>&lt;0.0001</td>
<td>21.466</td>
<td>Extremely Significant</td>
</tr>
<tr>
<td>Group(B)</td>
<td>36 ± 6.40</td>
<td>22.26 ± 4.30</td>
<td>&lt;0.0001</td>
<td>11.874</td>
<td>Extremely significant</td>
</tr>
</tbody>
</table>

Intra Group Comparison (within group) using paired t-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-Interventional Mean ± SD</th>
<th>Post-Interventional Mean ± SD</th>
<th>P value</th>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-Interventional Mean ± SD</th>
<th>Post-Interventional Mean ± SD</th>
<th>P value</th>
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<td>11.874</td>
<td>Extremely significant</td>
</tr>
</tbody>
</table>

Inter Group comparison (between Group) using unpaired t-test

### Table 3: Visual Analogue Scale (VAS)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre- Interventional Mean ± SD</th>
<th>Post-Interventional Mean ± SD</th>
<th>P value</th>
<th>t-value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>5.21 ± 1.78</td>
<td>1.96 ± 0.98</td>
<td>&lt;0.0001</td>
<td>6.971</td>
<td>Extremely Significant</td>
</tr>
<tr>
<td>Group (B)</td>
<td>5.36 ± 0.91</td>
<td>3.7 ± 0.60</td>
<td>&lt;0.0001</td>
<td>11.471</td>
<td>Extremely Significant</td>
</tr>
</tbody>
</table>

Intra group comparison (within Group) using paired t-test

### Table 4

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-Interventional Mean ± SD</th>
<th>Post-Interventional Mean ± SD</th>
<th>P value</th>
<th>t-value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Inter group comparison (between group) using unpaired t-test

### Table 5: Range of Motion (ROM) Knee Flexion

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre- Interventional Mean ± SD</th>
<th>Post-Interventional Mean ± SD</th>
<th>P value</th>
<th>t-value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>48.33 ± 7.84</td>
<td>112 ± 5.56</td>
<td>&lt;0.0001</td>
<td>50.995</td>
<td>Extremely Significant</td>
</tr>
<tr>
<td>Group (B)</td>
<td>43.2 ± 13.68</td>
<td>94.33 ± 14.37</td>
<td>&lt;0.0001</td>
<td>13.84</td>
<td>Extremely Significant</td>
</tr>
</tbody>
</table>

Intra group comparison (within Group) using paired t-test
Table 6

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-Interventional Mean ± SD</th>
<th>Post Interventional Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group(A)</td>
<td>48.33 ± 7.84</td>
<td>112 ± 5.56</td>
</tr>
<tr>
<td>Group(B)</td>
<td>43.2 ± 13.68</td>
<td>94.33 ± 14.37</td>
</tr>
<tr>
<td>P value</td>
<td>0.2180</td>
<td>0.0001</td>
</tr>
<tr>
<td>t-value</td>
<td>1.260</td>
<td>4.438</td>
</tr>
<tr>
<td>Inference</td>
<td>Not Significant</td>
<td>Extremely Significant</td>
</tr>
</tbody>
</table>

Inter group comparison (between group) using unpaired t-test

Results

Both the groups showed improvement but there was extremely significant improvement in WOMAC scale (p<0.001), ROM (p<0.001) and VAS (p<0.001) in group treated with the mechanical traction with mobilization. This data indicates that mechanical traction gives better result than the manual traction.

Discussion

This is a novel study which shows that the mechanical traction is more effective than the manual traction. All the analysis implies that mechanical traction with mobilization is extremely significant than the manual traction with mobilization. These findings demonstrated that the mechanical traction with mobilization increases the knee flexion range of motion and also improves the functional outcome of the post operative knee stiffness patients as compared to manual traction with mobilization.

By Dr. A C A Marijnissen (2007) reported the efficacy & underlying mechanisms of joint distraction in treatment of OA Knee Joint. He reported the efficacy & underlying mechanisms of joint distraction in treatment of OA Knee Joint. He found that joint distraction applies relief of modified skeletal wear & tear of articular cartilage surface forming a joint. Nutrition of the cartilage is maintained due to intra-articular fluid pressure changes during treatment. Additionally subchondral sclerosis is diminished; diminishing stresses on the cartilage after treatment. It is found in earlier studies that manual traction is effective in treating post operative knee stiffness. But manual mobilization has limitations like: limited maximum traction force, amount of force can’t be easily replicated or specifically recorded, can’t be applied for prolonged period of time and requires a skilled clinician. By using mechanical traction the force and time can be well controlled, readily graded and replicable.

In the previous studies, manual traction mobilization was applied to the TF joint. In this study, Mechanical traction mobilization applied to TF joint, there was significant increase in knee flexion. All participants experienced a mean increase of 64° in knee flexion from initial to final measurement. This change in range of motion was greater than the 25.9° flexion increase reported by Sara Maher and Doug Creighton, who applied tibio-femoral traction mobilization on passive knee flexion motion impairment.

In previous studies mechanical traction was found to be effective in osteoarthritis patients. The improvement in functional outcome after application of Mechanical Traction may be because of relief of abnormal pressure on nociceptive receptor system which shows that there is decrease in WOMAC scale. In previous studies only WOMAC scale was taken, but range of motion and visual analogue scale was not included.

This is the first study to compare the Kaltenborn traction with mobilization and mechanical traction with mobilization in post operative knee stiffness. This study shows that, patients treated with mechanical traction with mobilization significant improvement in range of motion, WOMAC scale, visual analogue scale as compare to patients treated with the Kaltenborn traction with mobilization which made the study more reliable.

It should be noted that the above results captured outcomes only immediately following treatment therefore no generalization can be made regarding long term effects. The study was limited to one geographical location. The study was done with limited period of duration. The favorable results in the current study indicate the need for future research for longer duration.
Conclusion

Various conservative approaches are used in treating post operative knee stiffness but this study concludes that mechanical traction with mobilization was more effective in decreasing pain and improving quality of life than using conventional therapy alone. It is proved from this study that the Kaltenborn traction with mobilization shows minimal effect in increasing the knee range of motion than compared to Mechanical Traction with mobilization.

Ethical Clearance: Institutional Ethics Committee Of Krishna Institute Of Medical Sciences Deemed University, Karad

Source of Funding: No funding required

Conflict of Interest: (If any then mention it otherwise write it as nil).

REFERENCES


A study of the Discharge Process of a Multi-Specialty Hospital

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ABSTRACT

Discharge and Billing process being the final step in the hospital experience is likely to be well remembered by the patient. Even if everything else went satisfactorily, a slow, frustrating discharge process can result in low patient satisfaction. Thus, this study was carried out with the aim to assess the discharge process and ascertain the average time taken for the patient to be discharged in a multi-specialty hospital. Method: Data of 150 TPA patients and 170 cash patients was recorded with the help of staff, HIS and observation. The average time taken for the whole discharge process of an individual patient was calculated using the data. Appropriate tables and graphs are used for representing various findings and results. Results and Conclusion: The average time taken for the whole discharge process for TPA and cash patients was 7 hours and 5 hours respectively.

Keywords: Discharge process, Billing process, multi-specialty, TPA

Introduction

Discharge can be broadly defined as ‘the processes, tools and techniques by which an episode of treatment and/or care to a patient is formally concluded by a health professional, health provider organization or individual’. It involves the development and implementation of a plan to facilitate the transfer of an individual from hospital to an alternative setting/home where appropriate. Mogli defines “discharge as the release of a hospitalized patient from the hospital by the admitting physician after providing necessary medical care for a period deemed necessary”¹. Sakarkar defines “discharge as the release of an admitted patient from the hospital”². Discharge process is defined as the process of activities that involves the patient and the team of individuals from various discipline working together to facilitate the transfer of patient from one environment to another³. Soon after completion of treatment, the patient as well as his or her escorts expects to be relieved off immediately. The delay in discharge process leads to dissatisfaction and affects the image of the hospital. Discharge time has important implications on the hospital working as it affects patient satisfaction, utilization of hospital resources, revenue generation, timely access to inpatient bed, assured continuity of care. The standard of discharge management impacts on hospital efficiency, quality and safety of patient care. Discharge process is the final step in the hospital experience, so the process is likely to be well remembered by the patient and his attendants. The Discharge Process is the process consisting of the activities that are undertaken before the patient finally leaves the hospital premises. These activities include making a Discharge Summary, collection of all the patient reports, generation of the Final Bill, Payment by the patient, escorting services etc. Even if everything else went satisfactorily, a slow, frustrating discharge process can result in low patient satisfaction.

Therefore, this time management study on discharge and billing process is undertaken with the aim of giving better services for the patient satisfaction within the minimum time. This can be done only with the help of thorough study of time taken for the whole discharge process beginning from Discharge order time till the patient leaves the Hospital.

Aim: To assess the discharge process of a multi-speciality hospital.

Objectives

- To study the current discharge process.
- To determine the delays if there are any.
- To suggest recommendations for improvements.
Methodology

Study Design:
- Retrospective study was done by asking staff members (Doctors, nurses, MT, billing)
- Self-observation was done by tracking the data on HIS.

Sample Area: IPD ward.

Sample Size: 150 TPA patients and 170 cash patients were taken and there were 20-25 daily discharges.

Review of Literature

Even under the best of circumstances, the discharge-planning process in hospitals is inherently complex with lots of ‘moving parts’. Information from many sources must be gathered, including patient-specific information regarding functional status and patient and family preferences, as well as information about available community resources. Alternatives have to be generated based on the information gathered, and one alternative must be selected and implemented. This selection involves trading off factors-which patients, their families, and health care providers may value differently. Added to this complexity is the environment in which these decisions are made, which is often one of time constraints and emotional distress. Hospital discharge planners generally recognize variations in patient characteristics when making their recommendations. Factors which discharge planners must consider include the availability of caretakers at home, age, multiple diagnoses, previous hospitalizations, and equipment dependence. Also, patients waiting for a place in their first choice of Nursing Home care to become available, and/or patients who did not have a family to assist them home are likely to be delayed. It is a combination of these individual, medical and organizational challenges that interact to put people at risk of delayed discharge.

Ideally the determination of the patient’s discharge plan begins upon their admission to a hospital. Based upon their presenting condition, physician order set, severity of illness or injury (SI), and the intensity of services required (IS) a resource plan of care and discharge plan can be identified up front for each patient. This would include the type of room or bed the patient may need, the anticipated equipment, diagnostic technology, and staff required for an effective patient flow experience at the hospital, and all necessary post-hospital care resources. The effective orchestration of these resources from admission through discharge facilitates a more efficient length of stay (LOS) and post-hospital care experience - directly impact patient satisfaction and hospital capacity management. When there is synchrony between the clinical and resource plan of care, patients receive the right services at the right time. For example, a patient will receive a prompt bed assignment, avoiding unnecessary delays. Or a patient gets transported in a timely fashion to diagnostics, and does not have to wait a significant period before being seen. Tests and results are processed efficiently, so that hours or days do not pass before results are back. Day of discharge and placement tasks can be coordinated to allow for a smooth hospital exit to post-hospital care as necessary.

It is not the clinical condition per se which causes the delay, but how organizations are managing services to care for people with these clinical conditions that cause the greatest delays. Coordinating the resource plan of care involves sequencing the anticipated services and procedures so that they are delivered in an efficient and timely fashion.

Findings

The hospital was facing problem due to delay in discharges which is leading to patient dissatisfaction. It was also causing unavailability of bed for new admissions. There was lack of clear communication and coordination between disciplines. Process for discharge was not streamlined. So, it was important to analyse the bottlenecks and take preventive and corrective actions to improve the process. From this study, it was found that there was delay in the discharge time. Number of Patients who were discharged after scheduled time was more than that before scheduled time. Discharge time for both cash and insurance patients was exceeding the norms of the hospital. Discharge process steps were analysed and reasons of delay found were late round of consultants, delay in correction of discharge summary, delay in insurance clearance, delay after billing settlement when patient is not prepared for discharge, and delay in arrival of stretcher.
Figure 1 depicts the number of delays in the Total Discharge process – beyond the TAT (2:00 hrs in cash & 5:00 hrs in TPA) (time at which doctor announced the discharge & patient physically moved out of the hospital)

No. of Patients Whose Discharge process was not completed in time

Figure 2: Process Time at Cash Counters

Figure 2 depicts delay in Pharmacy return after Doctor Announced the Discharge beyond TAT (10 minutes)

In this we considered the whole process between the doctors announced the discharge and patient moved out of the hospital. The time taken should be 5 hrs in TPA & 2 hrs CASH (TAT)

Out of 150 TPA patients and 170 cash patients, 80 and 140 patients respectively did not get their discharge process completed in time.

Their time exceeded up to 7 hours in TPA patients and 5 hours in Cash patients.

Figure 3: Opportunities & Time Lags

In this we considered the subsection between the doctors announced the discharge & pharmacy return took place. The time taken should be 10 min (TAT). Out of 150 TPA patients and 170 cash patients, for 40 and 45 patients respectively there was delay in sending the pharmacy return on time. Their time exceeded up to 20 minutes.

Figure 4, depicts the delay in preparation of final discharge summary after the completion of hand written discharge summary beyond TAT (45 min)

Fig. 4: Delay in preparation of final discharge summary
Here the subsection between the preparation of Final Discharge Summary and hand written Discharge summary was considered. The time taken should be 45 min (TAT). 50 patients out of 150 TPA patients and 40 patients out of 170 cash patients were those whose final Discharge summary was not prepared on defined time.

**Reasons observed were-**

- Doctors busy with the rounds
- Single MT
- Time taken for Corrections
- No staff for pharmacy return
- RMO busy with admissions
- Attendant not available for payment and other formalities
- No tentative discharges
- Doctor busy in OT
- Large no. of medicines which take more time to write an indent
- Same time room allotment
- HIS issues
- Delay in reporting
- Waiting for the ambulance
- Staff taking more time for Medicine Returns
- Internal disputes
- Activity taking 2-3 Hrs to reach the Billing
- Neuroscience summary takes longer times

**Recommendations:** Patients with delayed discharges were common. Reasons of delay were analysed and recommendations were given to reduce delay. If recommended measures are considered valid and applied in the system, the duration of time can be greatly reduced. Discharge intimation form and discharge checklist for patients and caregivers was made and recommended for implementation to reduce delay and enhance quality of discharge process. An improvement in the discharge procedure will increase the patient satisfaction immensely as discharge is observed to be one of the most common reasons for dissatisfaction amongst the patients. For effective discharge planning family, hospital staff, doctors, nurses must work together, performance standards should be frequently monitored and there should be openness to innovative solutions.

**A few more recommendations:**

- Implementation of online pharmacy
- Hiring of the staff
- Scheduling the time of support staff in Pharmacy, Reception & house keeping.
- All the Activity sheet will not go for the OT clearance
- Preparation of Tentative discharges before collection of all the reports.
- Improve the communication between doctors, nurse & patients.
- Special training should be given to the staff
- Enhancing the coordination between all the departments.

**Conclusion**

From this study, it was found that the total average time taken for TPA and cash patients to be discharged in a multi-specialty hospital was 7 hours and 5 hours respectively.

**Conflict of Interest:** There is no Conflict of Interest.

**Source of Funding:** Not funded by any agency.

**Ethical Clearance:** This study was conducted as a part of Summer Internship of MBA (HHM), and there is no ethical issues involved.

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ABSTRACT

Introduction: Hospitals currently operate in an environment of rapid socioeconomic and technical changes that raise concern for the quality of health care. Accreditation would be the single most important approach for improving the quality of care in hospitals. Rights of staff in a hospital are to be respected and protected.

Aim: was to study the awareness of the Human Resource Management standards as per NABH among the staff that is to be followed in the organization.

Materials & Method: Research design applied was descriptive method with questionnaire based survey, personal interview and direct observation of the hospital employees and studying relevant records.

Results & Discussions: The study revealed that on Crete steps in terms of initiating mechanism of action to ensure strict adherence to Human Resource management Standards and up gradation of the existing practices is necessary to comply with the NABH standards. There are many Standards which the staffs are not aware about and hence there is a need of training for Human resource management standards.

Conclusion: There is a need of proper communication system to be built. Training sessions should be held at such time so that the staff members are able to attend the training. Also there is a need of training with proper and adequate information on the standards.

Keywords: NABH, HRM, awareness, standards, hospital staff.

Introduction

The healthcare industry is potentially the world’s largest industry with total revenues of approximately US$ 2.8 trillion. In India as well, healthcare has emerged as one of the largest service sectors constituting 5 per cent of the gross domestic product (GDP) and offering employment to around 4 million people. India’s primary competitive advantage over its peers lies in its large pool of well-trained medical professionals. Also, India’s cost advantage compared to peers in Asia and Western countries is significant. In addition, changing demographics, disease profiles and the shift from chronic to lifestyle diseases in the country have led to increased spending on healthcare delivery. With many health care systems worldwide, increased attention is being focused on human resources management (HRM). Specifically, human resources are one of three principle health system inputs, with the other two major inputs being physical capital and consumables. When examining health care systems in a global context, many general human resource issues and questions arise. In Indian context, National Accreditation Board for Hospitals& Healthcare (NABH) has laid certain standards for implementation. The study assess in this context, the awareness related to the same amongst the employees of a tertiary care hospital in India.

Aim

To assess the level of awareness amongst the employees about NABH standards in tertiary care hospital.
Objective

The study objective was to understand level of employee awareness and implementation for HRM standards of NABH applicable in hospital they were working for with a view to suggest certain recommendations.

Limitation

The study was limited to only one tertiary care hospital.

Review of Literature

In the past, hospitals could, perhaps, afford the luxury of non-business like and of adopting hit-and-miss methods of management as a number of philanthropists made huge donations to meet the ever-rising deficit in hospital budgets. Similarly, in the field of human resource management, as long as the salary budget comprised only a small portion of the total budget, hospital administration could afford to neglect the introduction of scientific and progressive principles of human resource management. But they can no longer afford to do so as salary and wages now represent 65 per cent or more of the total hospital budget.4

Human resource is the most important resource of a Hospital. Human resource is an asset for effective and efficient functioning of a hospital. Human resources, when pertaining to health care, can be defined as the different kinds of clinical and non-clinical staff responsible for public and individual health intervention. As arguably the most important of the health system inputs, the performance and the benefits the system can deliver depend largely upon the knowledge, skills and motivation of those individuals responsible for delivering health services. HRM in health has to function in a sector with some unique characteristics. The workforce is large, diverse, and comprises separate occupations often represented by powerful professional associations or trade unions. Some have sector-specific skills; other can readily move from the health sector to employment in other sectors. The avowed first loyalty of those with sector-specific skills and qualifications (physicians, nurses, etc.) tends to be to their profession and their patients rather than to their employer.

Often the behavior of personnel is cited as one of the major reasons for the poor perception of healthcare services.5 Thus in order to improve the quality of the Human Resource Management Practices in hospitals National Accreditation Board for Hospitals & Healthcare Providers (NABH) has setup several standards for Human Resource Management.

Higher organizational effectiveness, machines, technologies, procedures and systems are no doubt important; but what is more important is the quality of the individuals behind them. Managing the human assets in any organization, be it hospitals or otherwise, is a far more difficult proposition than managing the other physical and financial aspects. All organizations, whether big or small, manufacturing or service oriented, profit or non-profit making, are basically human organizations. Hospitals or healthcare institutions are not different from this and are very much dependent on their human resource. Managing qualified human resource is a key to success and healthcare, as a labor-intensive sector, is bereft with problems. Human resource plays a significant role in the effective performance of a hospital. This depends to a great extent on the quality of its staff—the better their quality, the higher the level of performance.6

Thus a systematic study of the awareness of the NABH standards related to Human Resource Management among the staff members of the hospital is expected to be helpful to know whether the staff members are aware of their rights and responsibilities, whether the staff members know the Human Resource Management practices followed in the organization as it would help the HR Managers to identify the need for training related to this Human Resource Management standards of NABH which will help them to achieve quality standards of HRM for accreditation. This will also increase the productivity and satisfaction of the employees and benefit the management, which eventually will work to the advantage of the end users of the society as a whole.

Material and Method

The study was conducted to assess the awareness level of the staff of the 105-bedded tertiary care hospital about the NABH Human Resource Management standards that are followed in the hospital for 246 staff members, out of which 112 staff members from were included in the study due to time and other constraints. The study design adopted for the purpose was exploratory and descriptive in nature along with direct observation of hospital staff members and also studying relevant records of the hospital and was conducted for a period of two months.
Convenience random sampling was adopted. Total 30 departments were covered which included 112 staff members of the hospital. The staff members consisted of nurses, paramedical staff, administrative staff and front office executives. For the purpose of the study, a questionnaire was formulated and administered to 112 staff members of the hospital. The study instrument consisted of 12 questions covering most of the NABH standards related to Human Resource Management which was aimed to assess awareness about the NABH Standards of HRM in the hospital. Responses were obtained on dichotomous scale only, as the objective was limited to assess the awareness. Results obtained were verified, codified and valid percentage was obtained with the use of SPSS version 18.

**Observations & Results**

The demographics details along with distribution of responders in various categories of employment is given in Figure. 1.

**Fig. 1: Demographic Profile details**

The staff member consisted of 43% female and 57% male staff. Further the staff had mix of various categories such as nursing personnel’s, paramedical staff, and administrative staff and support service staff members. The female population mostly consisted of the nursing staff, and the male population mostly consisted of administrative and other staff. The composition of staff members is presented in Fig. 2:

**Fig. 2: Composition of staff distribution**

Following are the findings (table 3) that were obtained based on the responses of the staff members on section B of questionnaire which had questions about measuring the awareness level of the staff members:

**Table 1: Level of awareness of NABH standards**

<table>
<thead>
<tr>
<th>Area</th>
<th>Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Induction Training</td>
<td>91.9%</td>
</tr>
<tr>
<td>Safety Precautions</td>
<td>28.57%</td>
</tr>
<tr>
<td>Rights of Staff</td>
<td>34.82%</td>
</tr>
<tr>
<td>Training of Occupational hazard</td>
<td>41.9%</td>
</tr>
<tr>
<td>Grievance handling committee members</td>
<td>28.57%</td>
</tr>
<tr>
<td>Annual Health check-up</td>
<td>40.17%</td>
</tr>
<tr>
<td>Performance Appraisal System</td>
<td>58.9%</td>
</tr>
<tr>
<td>Need for Training</td>
<td>83.92%</td>
</tr>
</tbody>
</table>

**Discussion**

Earlier studies on Human resource management have just focused on the HRM practices followed in the organization or the comparison between the HRM practices followed in the organization or the satisfaction level of the employees related to the HRM practices followed in the organization but very few studies have been conducted on the awareness about HRM standards among the staff members that are followed in the organization. Today human resources occupy, more than ever, the center stage of all economic activities. It is alarming time for all those organizations that wish to be successful in global markets to gear up and implement desired shift in their prevailing human resource management practices and leverage their human resources along with the other resources.

As staff is an important asset of the organization they should be aware of the HRM standards for the knowing their rights and responsibilities. In the above study it was seen that although 91.9% of the staff members have undergone the induction training program in which training is also given on HRM standards of NABH still very few staff members knew about the objective elements in the NABH chapter 9 of HRM. Also objective element ‘e’ of “HRM standard 2” states that the staff members should be made aware of their rights and responsibilities at the time of induction but only 34.8% of the staff are aware of their rights. This
might be because of providing inadequate data about the standards in the induction training as the staff members also commented that they are not at all satisfied with data provided at the induction training program.

“Standard 3 of HRM” states that there is an on-going program for professional training and development of the staff but it is seen during the study that majority of the staff are still not aware of the training and development program conducted at the organization.

Standard 4 of HRM states that the staff should be adequately trained on various safety related aspects but it is seen in the study that only 28.57% of the staff are aware of the safety precautions to be taken. Thus the staff members should be given training on various safety related aspects. It is also mentioned in the objective element of the standard 4 of HRM that the training should also be provided on various occupational hazards but from the study it is seen that only 41.9% of the staff members are aware that HR department provides training on the occupational hazards. The objective element ‘b’ of “HRM standard 5” states that the staff members should be made aware of the performance appraisal system at the induction program but it is seen in the study that only 58.9% of the staff members are aware of the performance appraisal system followed in the organization which needs to be improved. HRM standard 7 addresses the health needs of the employees. Objective element ‘c’ of these standard states that Regular health checks of staff are done at least once a year. But it was found that only 40.17% of the staff members are aware of the annual health check-up programs conducted in the hospital thus the HR department should make efforts each and every employee should be made aware of the annual health check-up sessions.

**Recommendations**

1. There should be training program arranged on NABH standards related to HRM standards.
2. More information should be provided about the Human Resource Management standards at the induction training program.
3. The staff members should be made aware of their responsibilities towards patients.
4. Information about the safety precautions to be undertaken at the work place should be provided to the staff members.

5. The Human Resource department should see to it that the staff members must update their job description and job responsibilities.
6. Training on occupational health hazards should also be given to the staff members.
7. Information regarding the health check-up sessions conducted for the staff should be conveyed to all the staff members.
8. The schedule of the Training and development programs conducted by the Human resource department should be informed to each staff member.
9. Performance appraisal system followed in the organization should be communicated to the staff members.
10. The HR department should establish proper communication system for better flow of information through their website, circulars, and notices on the board, notice board in the cafeteria and staff rest rooms.
11. The training sessions should be scheduled in such a way that all the staff members are able to attend the training.

**Conclusion**

The study revealed that initiating mechanism of action to ensure strict adherence to Human Resource management Standards and up gradation of the existing practices is necessary to comply with the NABH standards. There are many Standards which the staff is not aware about and hence there is a need of training for Human resource management standards. Although there are few standards in which the staff members does not need any training but there are many of which the staff is not aware about and there are many reasons behind this like staff has not attended the training due to their busy schedule, they are not aware that such training is being conducted and the most important reason is improper communication system between the HR department and the staff members. There is a need of proper communication system to be built between the Human Resource department and the staff members. Moreover, the training sessions should be held at such time so that the staff members are able to attend. Also there is a need of training with proper and adequate information on the standards.
Conflict of Interest: There is no Conflict of Interest.

Source of Funding: The study is not funded by any agency.

Conflicts of Interest: The study was a part of Summer Internship of MBA (H HM) student, addressing the managerial & administrative issues. So, no Ethical clearance was required.

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Prescribing Pattern of Anti Fungal Drugs in Dentistry- A Cross Sectional Study in a Private Dental College in Chennai

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ABSTRACT

Aim: The purpose of this survey was to assess the awareness about the antifungal drugs and its various uses in dentistry.

Materials and Method: A pre-tested interviewer administered questionnaire was distributed among the post graduates and dental practitioners in a private dental college in chennai. The questionnaire consisted of 15 questions. It included the questions related to the importance of antifungal drugs used in various dental infections. Data from the received questionnaires were entered into a computer database and analysed and descriptive statistics were produced.

Results: The most popular antifungal drug prescribed was fluconazole 53% followed by clotrimazole 30% and nystatin 9%, miconazole 5% and chlorhexidine 3%. It was found that these antifungal drugs were used to treat oral candidiasis which is one of the serious oral fungal infection.

Conclusion: This study could give light to the prescribing pattern of antifungal agent in dental office as treatment of many diseases like cancer and bronchial asthma are associated with fungal infections and it is of concern to overcome from it for better oral health.

Keywords: Anti fungal drugs , Candidal infection, Prescription, Dentist

Introduction

Fungal infections are extremely common and some of them are serious and even fatal. Candidiasis refers to an infection of the skin, mucosa and rarely of the internal organs caused mainly by Candida albicans and other candidia species. One of the mucosal lesion include oral candidiasis or oral thrush, found commonly in bottle fed infants and aged people. In this condition creamy white patches appear on the tongue or buccal mucosa. Fungi generally constitute a relatively small, proportion of oral microflora. The perfect fungi that divide by sexual reproduction are rarely isolated from oral cavity but occasionally found in infecting patients with advanced acquired immunodeficiency syndrome. Hence it is an opportunistic endogenous infection. The perfect fungi causing oral infections are Aspergillus, Geotrichium and Mucor species. The imperfect yeasts or yeast like fungi such as Candida species which divide by asexual reproduction that is by budding and fission are mostly found in the oral cavity. There are nearly five types of candida species which are seen in the oral cavity. Candida tropicalis, Candida parapsilosis, Candida albicans, Candida krusei , Candida guilliermondii. Among these five types, Candida albicans are commonly seen in the oral cavity. Hence it is one of the main components of normal oral microflora and around more than 50% people carry this organism. Candida albicans have recovered from the patient’s mouth of different age groups. There are few local factors such as acid saliva, xerostomia, night use of prosthetic dentures, tobacco, carbohydrate rich diets that make the oral tissues susceptible to
Fungal infections are usually more difficult to treat than bacterial infections because fungal organisms grow slowly. Increased oral candidal colonization can predispose to rhomboid glossitis (central papillary atrophy), atrophic glossitis, denture stomatitis, pseudomembranous candidiasis (thrush), and angular cheilitis. The main drugs used to treat these fungal infections are fluconazole, amphotericin B, clotrimazole, nystatin and ketoconazole. Hence this study reflects on the importance of anti fungal drugs and their effects and the necessity for dentists to have a thorough knowledge about them.

**Materials and Method**

A pre-tested interviewer administered questionnaire based study was conducted among 100 post graduates and dental practitioners in Chennai. It consisted of 15 questions regarding the most commonly prescribed antifungal agents used for candidial infections. The data received was compiled in the form of computerised chart and was analysed using SPSS software. The frequency, percentage, valid percentage and cumulative percentage for each question were calculated and corresponding graphs were drawn.

**Results**

In this study, the most commonly prescribed antifungal drug was fluconazole 53% followed by clotrimazole 30% and nystatin 9% (Fig 1) 84% of dentists preferred antifungal drugs for oral candidiasis and 16% preferred for other fungal infections. Topical antifungals were preferred as the first line for oral candidiasis by 86% of doctors and 14% of the dentist prescribed systemic antifungals (Fig 2). Majority of the dentists (99%) preferred treating oral candidiasis after diagnosis. 93% of the dentists stated that denture stomatitis is one of the frequent cause of oral candidiasis(Fig 3). Surprisingly majority of the dentists (98%) preferred prescribing antifungal drugs (Fig 4). 88% of dentists prescribed antifungal drug for oral candidiasis alone,2% preferred for non candidial infections alone whereas 10% of dentists prescribed it for both oral and other fungal infection.Among the factors like age, gender, economic status of the patient 17% considered age .4% considered only sex whereas 79% considered both age and sex of the patient(Fig 5). Among the side effects caused by antifungal drugs, the most commonly chosen answer was allergy (53%), followed by nausea (25%), vomiting (12%), blurring of vision (4%) and other side effects (6%)(fig 6).
address all possible etiological factors before the decision of antimicrobial resistance. The treatment plan should on the antifungal drug is made. The present study pathogenesis of disease and the worldwide problem infection treated using antifungal drugs. 88% of the dentist itraconazole have been the most extensively studied and preferred antifungal agents to treat oral candidiasis while antifungal drugs. Oral candidiasis was the most important infection treated using antifungal drugs. 88% of the dentist preferred antifungal agents to treat oral candidiasis while 2% preferred for non candidial infections and 10% of the dentists preferred using antifungal drugs for both candidial and non candidial infection. From this study it was found that 99% of doctors preferred treating oral candidiasis after been diagnosed.

Topical antifungal therapy for oral candidal infections is available in many forms like pastilles, troches, creams, ointments and oral suspensions and remains the cornerstone of treatment in mild, localized cases of candidiasis in healthy patients. Antimicrobial activities of various herbs and spices in plant leaves, flowers, stems, roots, or fruits have been reported by many workers. A wide variety of secondary metabolites, such as tannins, terpenoids, alkaloids, quinones and flavonoids are endowed with antimicrobial properties. 86% of dentists preferred topical antifungal therapy as the first line for oral candidiasis. However, remaining 14% preferred systemic antifungals. Studies conducted early by Mohammad Al-Beyari 1988 it was revealed that systemic antifungal agents were recommended for patients with poor compliance such as patients with special needs and immunocompromised patients. Among systemic antifungal drugs, fluconazole and itraconazole have been the most extensively studied and proven as efficient antifungal drugs.

From this study it was found that denture stomatitis was one of the main cause for oral candidial infections. 93% of the dentist supported that oral candidiasis was seen mostly among denture where as 7% mentioned some other causes rather than denture stomatitis. In a previous study conducted in the year 1986 related to the role of antifungal agents in denture associated stomatitis it was found that the main cause of developing oral candidial infection was dentures. Denture prosthesis may produce a local environment of lowered pH and anaerobic conditions by decreasing the flow of oxygen and saliva to the underlying tissue; these conditions favour fungal overgrowth. Furthermore, biofilm in denture plaque represent a protective reservoir for oral microbes. It was also demonstrated that Candida organisms have an affinity for the tissue side of the denture and although Candida infection is the primary aetiology of most of these lesions, other factors such as poor denture hygiene and associated bacterial flora, continuous denture wearing, ill-fitting and traumatic dentures, carbohydrate-rich diet and rarely, allergy to denture material are contributory co-factors. It was also found that wearing denture at night and smoking were associated with the most extensive infection.

It was noted that 84% of the dental practitioners used antifungal drugs to treat only candidial infection whereas 16% of the dentist used this antifungal agents to treat other infections than oral candidiasis. Fluconazole was the main drug prescribed by the doctors. 53% preferred fluconazole, 30% preferred clotrimazole, 9% preferred nystatin, 5% and 3% of dentist preferred miconazole and chlorhexidine respectively. A similar study was done by Lewis et al 1989 and involved questioning about antibacterial and antiviral agents also. However, in that study like the present study, fluconazole was the most popular antifungal prescribed. There has also been an apparent increase in the proportion of practitioners prescribing clotrimazole in the present survey compared with 1987 and it has now become more popular than other antifungal drugs. This study shows that in some instances the choice of antifungal agent is dependent on the form of candidiasis being treated, the questionnaire was not prescriptive for the clinical form of candidiasis and merely asking for all the antifungal agents routinely prescribed in general dental practice.

Fluconazole is a more recent systemic antifungal agent, belonging to the triazole group, which has a long half-life and therefore can be administered in a single daily dose (50 mg), which increases compliance. It has been widely used in the immunocompromised for the
treatment of oral candidiasis when it is often used for prolonged periods; this has lead to the emergence of resistant strains of Candida albicans. A single high dose (150 mg) formulation of fluconazole is now used to treat candidial infections. Like miconazole, fluconazole has significant drug interactions and should be used cautiously in liver disease.

The dose preferred for each drug was different and it depends upon the severity of the infection as well as the drug used. From this study 79% of dentists stated that the dose have effect on the age as well as sex of the patient. There are many side effects associated with antifungal drugs. 53% of dentist stated that there are many allergic reactions associated with antifungal drugs. Other side effects include nausea 25%, vomiting 12%, blurring of vision 4%-6% of the dentists cited some other side effects associated with antifungal drugs.

**Conclusion**

Present study reveals that, antifungal drugs are mostly prescribed by dentists for candidial infections. Fluconazole is the most commonly used antifungal agents. Majority of the dentists preferred topical antifungal agents than systemic antifungal agents. The factors such as age and sex have more effect on the choice and dosage of these drugs. Allergy and nausea were the most common side effects associated with the use of antifungal drugs. Maintenance of oral hygiene and early diagnosis as well as treatment can overcome from fungal infections.

**Conflict of Interest:** Authors report that there is no conflict of interest of any kind.

**Statement of Informed Consent:** Informed consent was obtained from the concerned authorities and from the subjects before the study.

**Statement of Human and Animal Rights:** No harm was inflicted on any humans on conduction of this study.

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Effect of Faradism Under Pressure with Biofeedback Exercises in Ca-Breast Lymphedema

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ABSTRACT

Background: CA-breast is the most commonly diagnosed cancer in women with 15% prevalence. CA-breast lymphedema is most common complication of mastectomy. Treatment options available for lymphedema is currently limited to application of massage, active exercises and faradism under pressure. As alone faradism under pressure was found to be effective in treating ca-breast lymphedema but as there is limited research available to show any significant impact of biofeedback exercises with simultaneous application of faradism under pressure on lymphedema, so this made indeed to study the effect of faradism under pressure with biofeedback exercises in ca-breast lymphedema.

Aim: Effect of faradism under pressure with biofeedback exercises in Ca-breast lymphedema.

Study design: The study design was Pre test-Post test single blinded study.

Method: A total 30 women were allocated into 3 groups using convenient sampling technique. Group (A) received Faradism under pressure with simultaneous biofeedback exercises, group (B) received Faradism under pressure without biofeedback exercises and group (C) received only Faradism under pressure. Each group received treatment for 3days/week for 4 weeks. Pre and post treatment assessment was taken using VAS, Limb girth, volumetric assessment and Goniometry (shoulder, elbow and wrist) as outcome measures.

Statistical Analysis: data was analyzed using Paired’t’ test and ANOVA-repeated measure.

Result: In this study group (A) showed better effect on outcome than group (B) and (C). volumetric assessment P value was 0.4409 which was not significant. On other outcome measure VAS, Limb girth and goniometry was extremely significant. Thus this study shows extremely significant improvement in group (A) treated with Faradism under pressure with simultaneous biofeedback exercises.

Conclusion: Faradism under pressure with simultaneous biofeedback exercises are effective in treating CA-breast lymphedema which improves subjects functional as well as personal outcome in daily life than conventional treatment alone.

Keywords: CA-breast, Lymphedema, Biofeedback exercises, Faradism under pressure.

Introduction

Cancer is a disease which affects all type of living beings. There is no organ in the body in which cancer cannot develop.¹ CA-breast is the most commonly diagnosed cancer in women with 15% prevalence.¹² The most obvious feature of many cancer is the development of new growth.¹² New growth or neoplasm implies the growth of newly formed cells from normal body cells or their preceding development cells of origin. The new growth often, but not invariably, forms a lump or tumor, a term frequently used synonymously with neoplasm.
Malignant neoplasm or cancer which if untreated may destroy the host. 3,4

Cancer has many treatment options such as chemotherapy, radiation therapy, medical management, surgical management etc. Mastectomy is one of the surgery for breast cancer. 1,3,5,6,7,8

Some complications may occur after breast cancer surgery like wound infection, seroma, pneumothorax, tissue necrosis, hemorrhage, injury to neurovascular structure of the axilla and lymphedema etc. Lymph edema is one of the leading complication of Ca breast. 3,4,7

Lymph edema is the accumulation of protein-rich fluid in soft tissue as a result of interruption of lymphatic flow. 3,9,10 Lymphedema is one of the leading complication of Ca breast. 3,4,7 Lymph edema is a chronic, progressive and often debilitating condition. 7 In post mastectomy patient lymph edema has the potential to become a permanent and progressive. 7 Lymph edema is result of the functional overload of the lymphatic system in which volume exceeds transport capacities. 6 Once the condition progresses it become treatment resistance.

Lymph edema may lead to fibrosis of tissue. 1,2,3 It’s a result of deposition of protein-rich fluid in interstitial tissues. This protein-rich fluid becomes growth medium for bacteria and fungi. 3,9,10 This may lead to recurrent infection of affected limb. With each infection lymphedema condition may worsen. 3,6,8 If the lymphatic system is blocked or damage, edema accumulates over a period of time which may lead to thickening of the tissue. 3,6,8

Complications of lymph edema are limb enlargement, feeling of heaviness, mild discomfort, pain, joint immobility, skin changes, chronic inflammation etc. 2,3

Physiotherapy treatment options available for lymph edema are massage, active exercises and faradism under pressure. 2 Thus as damage to lymph node is the main root cause of lymph edema hence a better treatment approach which will focus on complication of lymph edema will be more effective than low frequency current and exercises alone.

Faradism under pressure was found to be effective in treating Ca-breast lymph edema but there is limited research available to show any significant impact of biofeedback exercises with simultaneous application of Faradism under pressure on lymph edema. So this made indeed to study the effect of Faradism under pressure with biofeedback exercises in Ca-breast lymph edema.

Materials & Method

Single blinded experimental study with 30 women of post-operative ca-breast lymph edema was included in this study. Inclusion criteria : swelling over upper limb, post-operative Ca-breast surgery, post Ca-breast radiotherapy, axillary lymph node dissection, unilateral upper limb lymph edema and stage 1 lymph edema. 5,7,8,9 Exclusion criteria : any other breast pathology, received prior any lymph edema treatment in last six months, open wound, deep vein thrombosis, affected side fracture and any other soft tissue injury. 5,7,8,9 The study was approved by the ethical committee. Written consent was obtained from all subjects. The subjects were allocated into 3 groups using simple random sampling using lottery method.

Procedure

Group A- received faradism under pressure [FUP] with biofeedback exercises. An electrical stimulator delivered faradic current from 50 to 100 Hz and electrodes were placed directly over lymph edema for 15 minutes. Crepe bandage was applied with elevation of the limb. Sphygmomanometer was used to perform biofeedback exercises. The subjects were instructed to press the cuff of sphygmomanometer to get visual biofeedback as the mercury level elevated.

Group B- received FUP with exercises but no biofeedback

Group C- received only FUP

All 3 groups received treatment for 3 days/week for 4 weeks.

Pre treatment and post treatment assessment was done using VAS, girth measurement, volumetric measurement and goniometry.

Outcome Measure

VAS was used to assess the severity of the pain. 4

Limb girth: For upper limb above elbow and below elbow was taken. 9

Volumetric assessment: Volumetric assessment works on Archimedes principle. 7

Goniometry: The range of motion were taken for shoulder, elbow and wrist joints. 7,9
Results

Total 30 women were included in study. [30 subjects 13 were right side affected and 17 were left side affected]

Age Group of all patients ranged between 40-60 years with the mean of individual Group A was 58.3, Group B was 55.4 and Group C was 56.4 which was statically not significant.

### Table 1: VAS-at rest

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-interventional Mean ± SD</th>
<th>Post-interventional Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>3.95 ± 1.92</td>
<td>0.30 ± 0.34</td>
</tr>
<tr>
<td>Group (B)</td>
<td>3.85 ± 1.41</td>
<td>0.65 ± 0.41</td>
</tr>
<tr>
<td>Group (C)</td>
<td>3.55 ± 1.55</td>
<td>0.70 ± 0.25</td>
</tr>
<tr>
<td>P Value</td>
<td>0.8488</td>
<td>0.0578</td>
</tr>
<tr>
<td>F value</td>
<td>0.1655</td>
<td>3.353</td>
</tr>
<tr>
<td>Inference</td>
<td>Not significant</td>
<td>Very significant</td>
</tr>
</tbody>
</table>

### Table 2: VAS on Activity

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-interventional Mean ± SD</th>
<th>Post-interventional Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>7.30 ± 1.67</td>
<td>0.70 ± 0.34</td>
</tr>
<tr>
<td>Group (B)</td>
<td>6.45 ± 2.02</td>
<td>1.60 ± 0.93</td>
</tr>
<tr>
<td>Group (C)</td>
<td>7.55 ± 1.32</td>
<td>1.55 ± 0.43</td>
</tr>
<tr>
<td>P Value</td>
<td>0.3342</td>
<td>0.0036</td>
</tr>
<tr>
<td>F value</td>
<td>1.166</td>
<td>7.827</td>
</tr>
<tr>
<td>Inference</td>
<td>Not significant</td>
<td>Very significant</td>
</tr>
</tbody>
</table>

Limb girth- above elbow - showed that pre-treatment there was statistically considered significant difference seen with P values of 0.0403. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was extremely significant difference seen with P = <0.0001. Shoulder abduction- showed that pre-treatment there was statistically not significant difference seen with P values of 0.2576. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.1651. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.2160. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was significant difference seen with P = 0.0162. Shoulder medial rotation this shows that pre-treatment there was statistically not significant difference seen with P values of 0.2339. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.4277. Elbow-flexion: showed that pre-treatment there was statistically not significant difference seen with P values of 0.5024. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.0045. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was very significant difference seen with P = 0.0079.

### Table 3: Volumetric assessment

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-interventional Mean ± SD</th>
<th>Post-interventional Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group (A)</td>
<td>1550.0 ± 430.12</td>
<td>1150.0 ± 408.93</td>
</tr>
<tr>
<td>Group (B)</td>
<td>1420.0 ± 505.09</td>
<td>1240.0 ± 499.33</td>
</tr>
<tr>
<td>Group (C)</td>
<td>1430.0 ± 499.00</td>
<td>1400.0 ± 484.77</td>
</tr>
<tr>
<td>P Value</td>
<td>0.8000</td>
<td>0.4409</td>
</tr>
<tr>
<td>F value</td>
<td>0.2260</td>
<td>0.8574</td>
</tr>
<tr>
<td>Inference</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

Goniometry-shoulder–flexion: Showed that pre-treatment there was statistically not significant difference seen with P values of 0.2070. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.5341. Shoulder extension showed that pre-treatment there was statistically very significant difference seen with P values of 0.0045. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was extremely significant difference seen with P values of 0.0001. Shoulder abduction- showed that pre-treatment there was statistically not significant difference seen with P values of 0.2576. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.9643. Shoulder lateral rotation showed that pre-treatment there was statistically not significant difference seen with P values of 0.2339. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.4277. Elbow-flexion: showed that pre-treatment there was statistically not significant difference seen with P values of 0.5024. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.2071. Wrist- flexion: showed that pre-treatment there was statistically extremely significant difference seen with P values of 0.0001. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was very significant difference seen with P = 0.0002. Wrist- extension: showed that pre-treatment
there was statistically significant difference seen with P values of 0.0236. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was not significant difference seen with P = 0.5762. Wrist-ulnar deviation: showed that pre-treatment there was statistically not quite significant difference seen with P values of 0.0724. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was extremely significant difference seen with P = 0.0001. Wrist–radial deviation: showed that pre-treatment there was statistically not significant difference seen with P values of 0.9051. While on comparing the post treatment values, the results between the two Groups using ANOVA-repeated measure test revealed that there was very significant difference seen with P = 0.0037. In this study group A has shown improvement may be because of the simultaneous application of faradism under pressure and biofeedback exercises. Biofeedback exercises gives motivation and encouragement to patients to put efforts for better results. Simultaneous application of exercises with faradism under pressure drains lymphedema faster and reduce the recovery time as well.

**Discussion**

In this study simultaneous application of faradism under pressure with biofeedback exercises were done on postoperative CA-breast lymphedema. Reviewing various studies it was analyzed that the low frequency currents and exercises are the treatment options for lymphedema. This study was undertaken considering all the mentioned points and the aim of this study was to evaluate the effect of faradism under pressure with biofeedback exercises in Ca-breast.

30 Patients (women), (17left and 13 right) diagnosed as post CA-breast lymphedema between the age group 40-60yrs were drawn from Krishna hospital OPD for study purpose. They were evaluated and divided into 3 groups by convenient sampling with random allocation method. 10 subjects were included in Group A who were treated with faradism under pressure with biofeedback exercises, 10 subjects were included in Group B were treated with faradism under pressure without biofeedback and 10 subjects were included in Group C treated only with faradism under pressure. A pre and post treatment outcome measures using VAS, limb girth, volumetric assessment and Goniometry (shoulder, elbow and wrist) were done. The specific treatment protocol was followed as per the group for 3days/weeks for 4 weeks.

**GROUP A:** All the subjects in this group received FUP with biofeedback exercises for 3days/week for 4 weeks from the physiotherapist, who was accredited to practice FUP with biofeedback exercises. An electrical stimulator machine delivered faradic current from 50 to 100 Hz, and 2 electrodes were placed directly over lymphedema. Crepe bandage applied from distal to proximal over electrodes placed affected limb. Pillows were kept under affected limb to get elevation. The intensity of the stimulator was adjusted to just below the pain threshold and the stimulation lasted for 15 minutes. The BP apparatus were provided to perform biofeedback exercises. The subjects were instructed to press the cuff of BP apparatus to get visual biofeedback on mercury. 10

**GROUP B:** All the subjects in this group received FUP without biofeedback exercises for 3days/week for 4 weeks. Again the same physiotherapist gave treatment to this group.

Same procedure were done only exercises given without biofeedback.

**GROUP C:** All the subjects in this group received only FUP for 3days/week for 4 weeks. Again the same physiotherapist gave treatment to this group. In this group subject get only faradism under pressure as this is control group.

The study on efficacy of low-frequency low-intensity electrotherapy and manual lymphatic drainage in the treatment of chronic upper limb breast cancer-related lymphedema. In this study it was found that there was no significant on comparing the changes in low frequency low intensity electrotherapy and manual lymphatic drainage in treatment of chronic upper limb breast cancer lymphedema. In previous study there are some limitations to be considered in this trial. First, the small sample size and the fact that patients were not blinded for the treatment they received are the greatest potential bias problems. Second, selecting chronic lymphedema patients limits the conclusion to only this chronic phase. In current study large sample size has included. Single blinded study has conducted. In this study acute stage of lymphedema has included.
The study on combined Physical Therapy, Intermittent Pneumatic Compression and arm elevation for the treatment of lymphedema secondary to an axillary dissection for breast cancer. Result of combined Physical Therapy can be considered as an effective treatment modality for lymphedema. Bandaging the arm is effective, whether its effectiveness is investigated on a heterogeneous group consisting of patients with upper and lower limb lymphedema from different causes. There is no consensus on the effectiveness of Manual Lymphatic Drainage. The effectiveness of skin care, exercises, wearing a compression sleeve and arm elevation is not investigated by a controlled trial. Intermittent Pneumatic Compression is effective, but once the treatment is interrupted, the lymphedema volume increases.

In conclusion of previous study, Combined Physical Therapy is an effective therapy for lymphedema. However, the effectiveness of its different components remains uncertain. Furthermore, high-quality studies are warranted. The long-term effect of Intermittent Pneumatic Compression and the effect of elevation on lymphedema are not yet proven.

In this study conventional (controlled) group has investigated. Faradism under pressure with biofeedback exercises this simultaneous application maintain the effect.

In this study group A has shown improvement may be because of the simultaneous application of faradism under pressure and biofeedback exercises. Biofeedback exercises gives a motivation and encouragement to patients to put efforts for better results. Simultaneous application of exercises with faradism under pressure drains lymphedema faster and reduce the recovery time as well.

**Conclusion**

This study shows that faradism under pressure with biofeedback exercises is highly effective and statistically significant in reduction of swelling and improvement in functional outcome for the patients with post-operative CA-breast lymphedema both clinically and statistically.

**Ethical Clearance:** Institutional Ethics Committee Of Krishna Institute Of Medical Sciences Deemed University, Karad

**Source of Funding:** No funding required

**Conflict of Interest:** If any then mention it otherwise write it as nil.

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7. Giuseppe Murdaca, MD, PhD; a Paola Cagnati, MD, PhD; a RossellaGulli, PhD; et al. Current Views on Diagnostic Approach and Treatment of Lymphedema. The American Journal of Medicine (2012);125, 134-140


Effectiveness of Spinal Mobilization with Arm Movement (Smwams) Versus Neural Tissue Mobilization in Cervical Spondylosis with Unilateral Radiculopathy

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¹BPT, ²Assistant Professor, ³BPT, Krishna College of Physiotherapy, KIMS DTU, Karad, Maharashtra, India

ABSTRACT

Background: Cervical spine is prone to pathologies because of its more mobility and poor anatomical support. Cervical spondylosis describes the age related changes in the cervical spine.

Objectives: To find and compare the effect of spinal mobilization with arm movement (SMWAM), neural tissue mobilization, hot moist packs and interferential therapy on pain and functional disability in treatment of cervical spondylosis with unilateral radiculopathy.

Method: 90 subjects with cervical spondylosis were screened out of which 79 fulfilled the criteria. It was a single blinded study in which pre and post treatment outcome assessment by VAS and NDI was taken by an outcome assessor. Subjects in Group A received spinal mobilization with arm movement (SMWAM), Group B received neural tissue mobilization and Group C received baseline treatment with hot moist packs and interferential therapy. All the three groups received 2 weeks’ treatment protocol during which 4 subjects discontinued the treatment.

Results: 75 subjects (male 29, female 46), participated in the study. Intra group comparison results showed statistically reduction in post interventional VAS and NDI score for all 3 groups (p<0.0001). Inter group comparison results showed that Group A was statistically significant in reducing VAS score (p=0.0017) and NDI score (p<0.0001) than Group B and Group C.

Conclusion: Both the group A and group B showed significant reduction in post treatment VAS and NDI scores than group C. SMWAM was more effective than neural tissue mobilization in reducing VAS and NDI scores in subjects with cervical spondylosis with unilateral radiculopathy.

Keywords: Mulligan Mobilization, Shacklock’s Neural Tissue Mobilization, Visual analogue scale (VAS), Neck disability index (NDI), Cervical Radiculopathy

Introduction

Cervical spine is known to have more mobility and poor anatomical support which makes it prone to pathologies¹. Neck pain is becoming increasingly prevalent in the society, secondary to back pain & causes significant impairment ²,³. The most common progressive disorder of cervical spine in elderly is ‘spondylosis’ which can be defined as vertebral osteophytosis secondary to degenerative disc disease. Disc degeneration involves many alterations in normal physiology associated with aging⁴. Chronic disc degeneration also can affect cervical vertebrae, facet joints and other joints. Degenerative changes can also be seen in associated soft tissue support such as posterior longitudinal ligament and the ligamentum flavum. Most commonly, degeneration is found at C5-C6 vertebrae,
followed by C6-C7 and C4-C5. Degenerative changes are associated with nerve impingement which gives rise to three clinical syndromes in cervical spondylosis—i) Axial neck pain ii) Cervical radiculopathy iii) Cervical myelopathy.

Space occupying lesion such as spondylotic spur, disc herniation or cervical osteophyte causes nerve root compression that leads to cervical radiculopathy. Radicular symptoms are seen in the ipsilateral upper extremity. Depending upon which nerve root is impinged, dermatomal pattern is followed in cervical radiculopathy. The prevalence of cervical radiculopathy is higher in fourth and fifth decade of life, estimated as 2.1 cases per 1000. Overall cervical radiculopathy has a prevalence reported as 3.3 cases per 1000 people.

Neck pain associated with cervical spondylosis is commonly treated by drugs, physiotherapeutic modalities or exercises. Physiotherapeutic modalities include: - Short wave diathermy, moist heat, cryotherapy, therapeutic ultrasound, transcutaneous electrical nerve stimulation, cervical traction. Physical therapy exercises are: - Neck retraction, neck extension, deep neck flexor and scapular strengthening exercises, manual therapy, active range of motion exercises, aerobic conditioning exercises and resisted exercises.

A New Zealand physiotherapist, Brian Mulligan found that spinal mobilization with arm movement provides immediate, significant and lasting changes in the patient’s condition. Appropriate spinal level is selected and a sustained mobilizing force is applied to that level while the patient performs arm movement provoking the pain. Spinal mobilization with arm movement must result in pain free movement.

Indications: End range shoulder pain or a painful arc, rhomboid pain while horizontal abduction or adduction, radiating pain in hand with arm movement.

Neural tissue mobilization reduces intrinsic pressure on the neural tissue and promotes optimal physiological function. It restore dynamic balance between relative movements of nerve tissue and surrounding mechanical interference. It is evident that in neck pain when a patient undergoes nerve tension stretching, there is significant improvement in range of motion.

Both the treatments were compared with a baseline treatment including hot moist packs and interventional therapy modality. There are very few studies published regarding Spinal Mobilization with Arm Movement. Also no study have compared both the treatments. The aim of this study was to examine whether Spinal mobilization with arm movement or neural tissue mobilization would lead to better outcomes in reducing pain and improving functional ability in the management of cervical spondylosis with unilateral radiculopathy.

Materials and Method

Case control study

Participants: A written consent was taken from 90 subjects clinically diagnosed with cervical spondylosis. They were screened and 79 subjects were selected by inclusion criteria. Both male and female subjects between age group 45-65 diagnosed with cervical spondylosis by fulfilling the Wainner et al. clinical examination criteria and having only unilateral radiculopathy were included. Exclusion criterion were as follows: 1) Subjects with bilateral radiculopathy 2) Traumatic injuries of upper limb and cervical spine 3) Any infectious disease of cervical spine 4) Any congenital deformity of spine 5) Any surgery performed on cervical spine 6) Dizziness. 4 subjects discontinued the treatment before 2 weeks. Pre and post treatment outcome measures of pain on VAS, functional disability using neck disability index for 75 subjects were recorded by an outcome assessor.

Interventions: Participants were divided into 3 groups by convenient sampling with random allocation. Intervention period of 5 days/week for 2 weeks was carried out. Group A received Spinal mobilization with arm movement (SMWAMs) (3 sets of 7-10 repetitions) along with the baseline treatment. Group B received neural tissue mobilization (30 seconds- 2 minutes, 5 sets) along with the baseline treatment and Group C received only baseline treatment with interventional therapy (frequency 100Hz, for 15 min) and hot moist pack for 15 min.
Data Analysis

Table 1: Comparison of pre and post visual analogue scale within groups

<table>
<thead>
<tr>
<th>GROUP</th>
<th>VAS PRE</th>
<th>VAS POST</th>
<th>‘p’ value</th>
<th>‘r’ value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>8.26 ± 1.15</td>
<td>4.47 ± 1.29</td>
<td>p &lt; 0.0001</td>
<td>0.4440</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>GROUP B</td>
<td>7.61 ± 1.26</td>
<td>4.78 ± 1.77</td>
<td>p &lt; 0.0001</td>
<td>0.5928</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>GROUP C</td>
<td>7.55 ± 1.08</td>
<td>5.88 ± 1.07</td>
<td>p &lt; 0.0001</td>
<td>0.7698</td>
<td>Extremely significant</td>
</tr>
</tbody>
</table>

In the present study pre-interventional mean VAS was 8.26 ± 1.15 in Group A, 7.61 ± 1.26 in Group B and 7.55 ± 1.08 in Group C, whereas post-interventional mean VAS was 4.47 ± 1.29 in Group A, 4.78 ± 1.77 in Group B and 5.88 ± 1.07 in Group C. Intra group analysis of VAS revealed statistically reduction in post interventional VAS score for all 3 groups. This was done by using Wilcoxon matched pairs test. Group A (p<0.0001), Group B (p<0.0001), Group C (p<0.0001)

Table 2: Comparison of pre-pre and post-post VAS in between groups

<table>
<thead>
<tr>
<th>GROUP</th>
<th>VAS PRE</th>
<th>VAS POST</th>
<th>‘p’ value</th>
<th>‘F’ value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>8.26 ± 1.15</td>
<td>4.47 ± 1.29</td>
<td>0.0689</td>
<td>2.778</td>
<td>Not quite significant</td>
</tr>
<tr>
<td>GROUP B</td>
<td>7.61 ± 1.26</td>
<td>4.78 ± 1.77</td>
<td>0.0017</td>
<td>6.947</td>
<td>Very significant</td>
</tr>
</tbody>
</table>

Intra group analysis of VAS was done by using One way ANOVA test. Pre intervention analysis showed not quite significant difference between group A, Group B and Group C (p = 0.0689). Post intervention analysis showed very significant difference between Group A, Group B and Group C (p = 0.0017).

Table 3: Comparison of pre and post NDI score within groups

<table>
<thead>
<tr>
<th>GROUP</th>
<th>NDI PRE</th>
<th>NDI POST</th>
<th>‘p’ value</th>
<th>‘r’ value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>57.71 ± 13.73</td>
<td>24.06 ± 6.18</td>
<td>p &lt; 0.0001</td>
<td>0.5225</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>GROUP B</td>
<td>54.37 ± 14.39</td>
<td>34.18 ± 13.99</td>
<td>p &lt; 0.0001</td>
<td>0.6765</td>
<td>Extremely significant</td>
</tr>
<tr>
<td>GROUP C</td>
<td>50.02 ± 8.17</td>
<td>39.96 ± 8.05</td>
<td>p &lt; 0.0001</td>
<td>0.5991</td>
<td>Extremely significant</td>
</tr>
</tbody>
</table>

In the present study pre-interventional mean score of NDI was 57.71 ± 13.73 in Group A, 54.37 ± 14.39 in Group B and 50.02 ± 8.17 in Group C, whereas post-interventional mean score of NDI was 24.06 ± 6.18 in Group A, 34.18 ± 13.99 in Group B and 39.96 ± 8.05 in Group C. Intra group analysis of score of NDI revealed statistically reduction in post interventional NDI score for all 3 groups. This was done by using Wilcoxon matched pairs test. Group A (p < 0.0001), Group B (p < 0.0001), Group C (p < 0.0001)

Table 4: Comparison of pre-pre and post-post NDI score in between groups

<table>
<thead>
<tr>
<th>GROUP</th>
<th>NDI PRE</th>
<th>NDI POST</th>
<th>‘p’ value</th>
<th>‘F’ value</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP C</td>
<td>50.02 ± 8.17</td>
<td>39.96 ± 8.05</td>
<td>0.0969</td>
<td>2.411</td>
<td>Not quite significant</td>
</tr>
</tbody>
</table>

Inter group analysis of NDI scores was done by using One way ANOVA test. Pre intervention analysis showed not quite significant difference between group A, Group B and Group C (p = 0.0969). Post intervention analysis showed extremely significant difference between Group A, Group B and Group C (p < 0.0001).

Table 4 Conted…

<table>
<thead>
<tr>
<th>GROUP</th>
<th>NDI PRE</th>
<th>NDI POST</th>
<th>‘p’ value</th>
<th>‘F’ value</th>
<th>Inference</th>
</tr>
</thead>
</table>

Discussion

The present clinical trial was conducted to compare the effectiveness of Spinal mobilization with arm...
movement (SMWAM) and neural tissue mobilization in cervical spondylosis with unilateral radiculopathy.

Male to female ratio was 1:1.5 in this study. A study including 30 subjects with male to female ratio 1:2 reported that both genders are equally affected with cervical radiculopathy but males show early degenerative changes in cervical spine and females show degenerative changes after menopause\(^1\). A higher percentage of females included in this study contributes to their menopausal factor. In another study it was stated that males are more commonly affected by cervical spondylosis than females at a ratio of 3:2\(^4\), which does not correlates the ratio in this study.

Subjects of the age group 45-65 were included in this study. Cervical spondylosis is a natural process of aging and it is seen in 95% of individuals by the age of 65 years\(^4\). The inclusion of samples in this study supports the prevalence rate of above study. Also prevalence of cervical radiculopathy is higher in fourth and fifth decade of life, estimated as 2.1 cases per 1000\(^0\).

In this study, group A had 11 males and 14 females. Group B had 11 males and 14 females. Group C had 7 males and 18 females. According to Fisher’s-Exact test, the difference is considered as not significant (p value = 0.2152)

The average mean age of participants in Group A was 53.48 ± 7.10, in Group B it was 51.64 ± 5.97 and in Group C 52.92 ± 6.39. According to One Way ANOVA test the difference is considered as not significant (p = 0.5938)

Wilcoxon matched pairs test was used to analyse the effect of SMWAMs in cervical spondylosis with unilateral radiculopathy and showed that there was extremely significant reduction in VAS score (p < 0.0001, r = 0.4440) and NDI score (p < 0.0001, r = 0.5225). (Table 1, Table 3)

In spinal mobilization with arm movement, spinal movement takes place when the shoulder girdle is moved, because of the muscle attachments from scapula to cervical and upper thoracic vertebrae. Also, it corrects the positional faults causing impingement of pain-sensitive structures such as nerve roots. Mobilization results in freeing the nerve so that radiating pain in the upper limb reduces\(^10,12\).

Wilcoxon matched pairs test was used to analyse the effect of Neural Tissue Mobilization in cervical spondylosis with unilateral radiculopathy and showed that there was extremely significant reduction in VAS score (p < 0.0001, r = 0.5928) and NDI score (p < 0.0001, r = 0.6765). (Table 1, Table 3)

Neural tissue mobilization restores the plasticity of nervous system. In neural tissue mobilization, the nerve, its sheath and structures surrounding it shift in relation to other such structures. This improves movement of the nerve in relation to its interface by increasing the flexibility of collagen. Shacklock’s neural tissue mobilization consist of combined movements of at least 2 joints. One movement lengthens the nerve while other movement decreases the length of nerve. This movement increase and decrease the nerve tension alternatively\(^12\).

Wilcoxon matched pairs test was used to analyse the effect of combined Hot Moist Packs and Interferential Therapy in cervical spondylosis with unilateral radiculopathy and showed that there was extremely significant reduction in VAS score (p < 0.0001, r = 0.7698) and NDI score (p < 0.0001, r = 0.5991). (Table 1, Table 3)

Hot moist packs increase metabolic activity of tissue by increasing blood flow and removing metabolic waste products. Also, application of heat stimulates the neural receptors in the skin and tissues which causes reduction in muscle spasm. Interferential therapy causes reduction in pain by blocking pain-gate and also by absorption of exudates\(^15\).

Comparison of Visual Analogue Scale scores between three groups was done by using one way Anova test to find out the effectiveness between three groups. The statistical analysis revealed that there was very significant difference in visual analogue scale scores in all three groups post treatment (p=0.0017). Group A was more efficient in reducing VAS scores than Group B and Group C post treatment. (Table 2)

Comparison Neck Disability Index score between three groups was done using one way Anova test to find the effectiveness between the three groups. The statistical analysis revealed that there was extremely significant difference in Neck Disability Index score in three groups post treatment (p <0.0001). Group A was more efficient in reducing NDI score than Group B and Group C post treatment. (Table 4)
Neural tissue mobilization mobilizes the nerve and improves the plasticity of nerve. Whereas, Spinal mobilization with arm movement mobilizes the vertebrae and muscles attached to them as well as reduces nerve impingement. Hence the above study showed better decrease in VAS and NDI scores with help of SMWAM in cervical spondylosis with unilateral radiculopathy.

It can be stated from above study that both SMWAM and neural Tissue Mobilization are helpful in reducing the symptoms of cervical spondylosis with unilateral radiculopathy than only conventional physiotherapy treatment. SMWAM yields better result outcomes than neural tissue mobilization and it is more efficacious and cost effective.

Result

Based on the results of the present study it is concluded that both the Groups A and B showed significant reduction in VAS and NDI scores. Group A showed extremely significant reduction in VAS and NDI scores than Group B in subjects with cervical spondylosis with unilateral radiculopathy.

Conclusion

Results supported that Spinal Mobilization with Arm Movement was more effective than Neural Tissue Mobilization in reducing VAS and NDI scores in subjects with cervical spondylosis with unilateral radiculopathy.

Conflicts of Interest: There were no conflicts of interest in this study

Ethical Clearance: Ethical clearance was taken from institutional committee of Krishna institute of medical science, deemed University, Karad.

Source of Funding: Source of funding is Krishna institute of medical sciences deemed University, Karad

REFERENCES


A Comparative Study on Awareness and Perception about Anemia among Urban and Rural Adolescent High School Girls

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ABSTRACT

Background: Adolescence is the formative period of life when the maximum amount of physical, psychological, and behavioural changes take place. During this stage the requirement of nutrition and micronutrients is relatively high. Therefore, adolescents, especially girls, particularly those between the ages of 12–15 years, are vulnerable to iron deficiency mainly because requirements are at a peak. In this connection, an attempt has been made to know the awareness and perception regarding anemia among adolescent girls.

Objectives:
1. To know the awareness and perception about anemia among urban and rural high school girls aged 13-16 years.
2. To know their awareness about health impacts of anemia during growth period and pregnancy.
3. To compare the awareness and perception on anemia between urban and rural high school girls.

Methodology: A school based cross sectional study was done for a period of one year (December 1, 2014 to November 30, 2015) among 650 adolescent high school girls of Davangere city & field practice area of JJM Medical College, Davangere, Karnataka using a predesigned, pretested, multiple response type of Questionnaire, designed for the study by interview method.

Results: Mean awareness score of rural girls was higher (2.86) compared to urban girls (2.20) which was found statistically highly significant, whereas mean perception score was almost same for both rural (2.02) & urban (2.03) adolescent high school girls & was found statistically insignificant.

Conclusion: The present study revealed that rural adolescent girls were more aware about anemia compared to urban girls, where as both urban and rural girls had same perception about anemia.

Keywords: High school; Adolescent girls; anemia; awareness; perception; prevalence.

Introduction

“Nutritional anaemia is a condition in which haemoglobin content of blood is lower than normal as a result of deficiency of one or more essential nutrients, regardless of the cause of such deficiency”[1].

In India, according to National Health and Family Survey (NHFS-3), the prevalence of anaemia among adolescent girls, 15-19 years, is 55.8٪. In Karnataka, according to National Health and Family survey (NHFS-
Adolescence is the formative period of life, in the age group of 10 to 19 years, when significant growth and maturation occurs. It is a time of increased demand for iron in the food, more so among girls, not only because of menstruation but also because of social factors like preference to feed more for male children, girls eating last whatever is left, being deprived of good food, workload of household chores, negligence of female children etc., making them vulnerable for the development of anemia. Thus adolescent period not only constitutes a critical period for the development of anaemia but also with the onset of menarche, they enter the reproductive life, constituting potential mothers.

In this connection, an attempt has been made to know the awareness and perception about anaemia among adolescent girls.

Objectives

1. To know the awareness and perception about anaemia among urban and rural high school girls aged 13-16 years.

2. To know their awareness about health impacts of anaemia during growth period and pregnancy.

3. To compare the awareness and perception on anaemia between urban and rural high school girls.

Materials & Method

The current cross sectional, school based, comparative study was undertaken in Davangere city and field practice area of JJM Medical College i.e. Anaji & Mayakonda for a period of one year from December 1, 2014 to November 30, 2015 among 650 adolescent high school girls aged 13 to 16 years of 8th to 10th standard i.e. 330 girls from government Seethamma girls H.S of Davangere city and 320 girls from government Deeveramama K. Vetteppa girls H.S of Anaji & G.SC-ST.G. Girls H.S of Mayakonda.

Sampling procedure:

Sample size estimation: According to National Family Health Survey (NHFS-3), the prevalence of anemia among school going adolescent girls is 55.8%. It is rounded up to 56%. Using this data, the following formula has been applied to determine the required sample size for the study.

\[ n = \frac{4pq}{d^2} \]

Where,

\[ n = \text{sample size}, \]
\[ p = \text{prevalence of anaemia i.e. 56\%}, \]
\[ q = 100-p = 100-56 = 44, \]
\[ d = \text{admissible error (10\% of p) = 10\% of 56 = 5.6}, \]
\[ n = 4\times56\times44/5.6\times5.6 = 9856/31.36 = 314.28. \]

The calculated sample size is 314. It is rounded up to 330 for the urban schools and 320 for the rural schools of the field practice area of the college, thus constituting a total of 650 adolescent high school girls as the study group. There are eight government girls high school in the city, each with strength of more than 300. So one school was selected at random, by Simple Random technique. There is one Girl’s high school in each of the three P H C’s attached to the college, each school with a strength of more than 160. So two schools were selected at random to obtain the required sample size.

Criteria for the selection of subjects:

Inclusion criteria: High school girls of 8th, 9th and 10th standard, who are in the age group of 13 to 16 years and who have attained menarche were included in the study

Exclusion criteria: Girls with chronic illness and heavy menstrual disorders and those with a history of regular consumption of IFA (Iron and Folic acid) tablets in the past three months were excluded from the study.

Method of data collection: Prior permission was obtained from the school authorities for the proposed study. Sampled schools were identified and school address was noted. Selected schools were visited on a prefixed date. Importance of the study was explained to all the girl students of 8th to 10th standards. An empty class room was provided by the school authorities to conduct the study. Selection of students was done by systematic random sampling method. The class teacher
and the students were briefed regarding the purpose of the study and confidentiality was maintained. The data was collected in a predesigned, pretested, multiple response type of Questionnaire, designed for the study by interview method. The students were briefed about the terms used in the proforma. Each participant was given a questionnaire and was instructed to tick one correct answer they know. The forms were collected soon after it is filled up.

The questionnaire was addressed on the topic of awareness of anemia, its health impacts and perception about anemia. Every question had a response of a right answer, a wrong answer and don’t know also, considering it as incorrect. The study variable of anemia are about the related system, related nutrient, hemoglobin level, dietary source, cause, early features and health impacts of anemia during growth period and pregnancy and also about their perception on anemia.

**Ethical clearance:** The present study was approved by ethical committee of JJM Medical College Davangere.

**Statistical analysis:** The collected information was compiled, tabulated & analyzed for results by using SPSS software package version 17.

**Statistical tests used:** Percentage, simple Proportion & Chi-square test.

**Results**

A total of 650 adolescent girls i.e 320 from field practice area of JJM Medical College & 330 from Davangere city were included in the study as shown in figure no 1.

![Distribution of adolescent girls according to residential area](image1)

**Fig. 1:** Distribution of adolescent girls according to residential area

**Table 1:** Distribution of adolescent high school girls by Age

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Rural</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-14</td>
<td>112</td>
<td>57</td>
<td>169</td>
</tr>
<tr>
<td>14-15</td>
<td>123</td>
<td>77</td>
<td>200</td>
</tr>
<tr>
<td>15-16</td>
<td>79</td>
<td>111</td>
<td>190</td>
</tr>
<tr>
<td>upto16</td>
<td>6</td>
<td>85</td>
<td>91</td>
</tr>
<tr>
<td>Total</td>
<td>320</td>
<td>330</td>
<td>650</td>
</tr>
</tbody>
</table>

Table 1 shows age of students ranged from 13 to 16 years of whom 112(35%); 123(38.44%); 79(24.69%) & 6(1.88%) from rural & 57(17.27%); 77(23.33%); 111(33.64%); 85(25.76%) from urban who were in the age group of 13-14, 14-15, 15-16 & 16 years respectively.

![Distribution of adolescent high school girls by Standard](image2)

**Fig. 2:** Distribution of adolescent high school girls by Standard
Figure 2 shows that out of 320 rural adolescent high school girls, 110 (34.38%) were from 8th standard, 110 (34.38%) were from 9th standard & 100 (31.25%) were from 10th standard, whereas out of 330 urban adolescent high school girls, 80 (24.24%) were from 8th standard, 100 (30.30%) were from 9th standard & 150 (45.45%) were from 10th standard.

### Table 2: Distribution of adolescent high school girls according to Awareness regarding various aspects of anaemia

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Variables</th>
<th>Urban Girls (N = 330)</th>
<th>Rural Girls (N = 320)</th>
<th>X² &amp; P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Related system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brain</td>
<td>37 (11.21%)</td>
<td>40 (12.50%)</td>
<td>X² = 61.8, p = 0.001</td>
</tr>
<tr>
<td></td>
<td>Lungs</td>
<td>177 (53.64%)</td>
<td>78 (24.38%)</td>
<td>Highly significant</td>
</tr>
<tr>
<td></td>
<td>Blood</td>
<td>50 (15.15%)</td>
<td>82 (25.63%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>66 (20%)</td>
<td>120 (37.50%)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Hemoglobin level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decreases</td>
<td>185 (56.06%)</td>
<td>165 (51.56%)</td>
<td>X² = 28.3, p = 0.001</td>
</tr>
<tr>
<td></td>
<td>Increases</td>
<td>17 (5.15%)</td>
<td>4 (1.25%)</td>
<td>Highly significant</td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>128 (38.79%)</td>
<td>30 (9.38%)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Related nutrient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iron</td>
<td>118 (35.76%)</td>
<td>133 (41.56%)</td>
<td>X² = 6.14, p = 0.10</td>
</tr>
<tr>
<td></td>
<td>Calcium</td>
<td>108 (32.73%)</td>
<td>77 (24.06%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sodium</td>
<td>14 (4.24%)</td>
<td>16 (5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>90 (27.27%)</td>
<td>94 (29.38%)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Dietary source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ragi</td>
<td>16 (4.85%)</td>
<td>26 (8.13%)</td>
<td>X² = 88.1, p = 0.001</td>
</tr>
<tr>
<td></td>
<td>Jaggery</td>
<td>9 (2.73%)</td>
<td>4 (1.25%)</td>
<td>Highly significant</td>
</tr>
<tr>
<td></td>
<td>Leafy vegetables</td>
<td>247 (74.85%)</td>
<td>151 (47.19%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All three</td>
<td>24 (7.27%)</td>
<td>114 (35.63%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>7 (2.12%)</td>
<td>3 (0.94%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>27 (8.18%)</td>
<td>22 (6.88%)</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Causes of anemia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decreased intake of nutrient</td>
<td>245 (74.24%)</td>
<td>92 (28.75%)</td>
<td>X² = 160.8, p = 0.001</td>
</tr>
<tr>
<td></td>
<td>Increased menstruation</td>
<td>7 (2.12%)</td>
<td>61 (19.06%)</td>
<td>Highly significant</td>
</tr>
<tr>
<td></td>
<td>Worm infestation</td>
<td>12 (3.64%)</td>
<td>57 (17.81%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All three</td>
<td>22 (6.67%)</td>
<td>58 (18.13%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>none</td>
<td>2 (0.61%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>42 (12.73%)</td>
<td>52 (16.25%)</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Early features of anemia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Headache</td>
<td>38 (11.52%)</td>
<td>34 (10.63%)</td>
<td>X² = 7.8, p = 0.16</td>
</tr>
<tr>
<td></td>
<td>Fatigue</td>
<td>195 (59.09%)</td>
<td>197 (61.56%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Breathlessness</td>
<td>24 (7.27%)</td>
<td>22 (6.88%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All the three</td>
<td>35 (10.61%)</td>
<td>22 (6.88%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>31 (9.39%)</td>
<td>43 (13.44%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>7 (2.12%)</td>
<td>2 (0.63%)</td>
<td></td>
</tr>
</tbody>
</table>

From Table 2, it is seen that 25.63% of the rural & 15.15% of the urban adolescent girls answered correctly that anemia is related to blood, 41.56% of the rural & 35.76% of the urban adolescent girls were aware that anemia occurs due...
to deficiency of iron in diet, 35.63% of the rural & 7.27% of urban girls knew correctly the various dietary sources of iron, 58(18.13%) rural girls & 22(6.67%) urban girls were aware that anaemia is caused due to decreased intake of nutrients, increased menstruation & worm infestation, 165(51.56%) of the rural adolescent girls & 185(56.06%) of the urban adolescent high school girls were aware that in Anaemia the haemoglobin level of blood is decreased and only 22(6.88%) of the rural girls & 35(10.61%) of urban adolescent girls were aware about the early features of anaemia like head ache, fatigue & breathlessness.

Table 3: Distribution of adolescent high school girls according to Awareness regarding health impacts of anemia

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Variables</th>
<th>Urban Girls (N = 330)</th>
<th>Rural Girls (N = 320)</th>
<th>X² &amp; P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Impact on growth, development and learning process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>231 (70%)</td>
<td>234 (73.13%)</td>
<td>X² = 1.5, P = 0.46</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>50 (15.15%)</td>
<td>49 (15.31%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>49 (14.85%)</td>
<td>37 (11.56%)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Impact on adverse effect on pregnancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Premature baby</td>
<td>114 (34.55%)</td>
<td>54 (16.88%)</td>
<td>X² = 36, P = 0.001 Highly significant</td>
</tr>
<tr>
<td></td>
<td>Dead newborn</td>
<td>39 (11.82%)</td>
<td>50 (15.63%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Both correct</td>
<td>61 (18.48%)</td>
<td>108 (33.75%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>116 (35.15%)</td>
<td>108 (33.75%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows 73% of the rural and 70% of the urban students were aware that anemia has an impact on growth, development and learning process where as 18% of urban and 34% of the rural students were aware that anemia in pregnancy can lead to birth of premature baby and death of newborn both and this difference was found statistically highly significant.

Table 4: Distribution of adolescent high school girls according to Perception about Anaemia

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Variables</th>
<th>Urban Girls (N = 330)</th>
<th>Rural Girls (N = 320)</th>
<th>X² &amp; P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Anemia is due to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of knowledge</td>
<td>141 (42.73%)</td>
<td>197 (61.56%)</td>
<td>X² = 46.5, P = 0.001 Highly significant</td>
</tr>
<tr>
<td></td>
<td>Bad luck</td>
<td>67 (20.30%)</td>
<td>13 (4.06%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evil effect</td>
<td>30 (9.09%)</td>
<td>31 (9.69%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>92 (27.88%)</td>
<td>79 (24.69%)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>How to protect against anaemia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exercise</td>
<td>65 (19.70%)</td>
<td>153 (47.81%)</td>
<td>X² = 78.8 P = 0.001 Highly significant</td>
</tr>
<tr>
<td></td>
<td>Good food</td>
<td>217 (65.76%)</td>
<td>138 (43.13%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Praying god</td>
<td>10 (3.03%)</td>
<td>22 (6.88%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Don’t know</td>
<td>38 (11.52%)</td>
<td>7 (2.19%)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Whom to consult if anaemic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Priest</td>
<td>1 (0.30%)</td>
<td>0</td>
<td>X² = 12.8 P = 0.005 Highly significant</td>
</tr>
<tr>
<td></td>
<td>Astrologer</td>
<td>6 (1.82%)</td>
<td>10 (3.13%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Doctor</td>
<td>312 (94.55%)</td>
<td>310 (96.88%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nobody</td>
<td>11 (3.33%)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 shows 43% of the urban and 62% of the rural students perceived correctly that anemia is due to lack of knowledge about the disease, 66% of the urban and 43% of the rural girls perceived correctly that anemia can be
prevented by taking good iron rich food and 95% of the urban and 97% of the rural students perceived that they have to consult the Doctor if found anemic and all the differences were found statistically highly significant.

**Table 5: Distribution of Mean Awareness & Perception score of adolescent girls by Residential area**

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Urban</th>
<th>Mean Difference</th>
<th>P* Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Awareness</strong></td>
<td>Range</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-8</td>
<td>2.86</td>
<td>1.55</td>
<td></td>
</tr>
<tr>
<td><strong>Perception</strong></td>
<td>Range</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-3</td>
<td>2.02</td>
<td>0.71</td>
<td></td>
</tr>
</tbody>
</table>

* Student’s unpaired t test

Table 5 shows Mean awareness score of rural girls about anaemia was higher(2.86) compared to Mean awareness score of urban girls(2.20) & this difference was found statistically highly significant, where as the Mean perception score was almost same for both rural(2.02) & urban(2.03) adolescent high school girls & this was not statistically significant.

**Discussion**

In our study 650 adolescent girls in the age group of 13-16 years were involved of which 330 were from urban & 320 were from rural areas. This was similar to a study conducted by Kaur. Deshmukh P R & Garg B S in rural Wardha which included a sample of 630 adolescent girls in the age group of 13-16 years,

It was found that in our study 59.85% girls told that they were aware of anaemia,41.56% told that anaemia occurs due to iron deficiency, 71.54% were aware that anaemia has an impact on growth, development & learning process in school children,where as in a study conducted by S Khedu in Moritius 90.6% of the respondents knew what the term anaemia meant, 78.3% could associate anaemia with micronutrient iron found in food & 86.4% were of the opinion that being anemic will reduce concentration in class.

In our study 61.23% girls answered that green leafy vegetables are the main dietary source of iron where as in a study conducted by Mammeet Kaur in Chandigarh 93% women were in favour of including green leafy vegetables in diet.

In our study 52% of the adolescents perceived that anaemia occurs due to lack of knowledge about disease,54.62% perceived that consumption of good food will help to protect against anaemia & 95.69% were having the perception that they have to consult the Doctors if found anemic, where as in a study conducted by Peggy Bentley among women of four Indian states, most of the women percieved that anemia presents as weakness,dizziness,blood loss & considered poor quality of diet as major reason for that & in a study conducted by Rae Galloway et. al most of the women did not know about anemia, its causes & prevention.They described anemia as thin blood, low blood, weakness, loss of blood, headache, dizziness.

**Conclusion**

The present study revealed that rural adolescent girls are more aware about anemia as compared to urban girls, where as urban girls percieved anaemia correctly as compared to the rural girls. So it is important that all adolescent girls are supposed to know about anaemia and its health impacts because of the menstruation process and in the interest to safeguard the future reproductive health.

**Funding:** None

**Conflict of Interest:** Nil

**Ethical Clearance:** The present study was approved by ethical committee of JJM Medical College Davangere, Karnataka.

**REFERENCES**


The Effectiveness of Mulligan’s Pain Releasing Phenomenon Versus Kinesio-Taping in De’quervains Tenosynovitis

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¹Physiotherapist, Faculty of Physiotherapy, ²Assistant Professor, Krishna college of physiotherapy, KIMS 'Deemed to be’ university, Karad, Maharashtra, India

ABSTRACT

Objectives: the purpose of this study was to compare the effectiveness of mulligan’s pain releasing phenomenon versus kinesio-taping in de’quervains tenosynovitis.

Method: 30 subjects diagnosed with dequervains disease were included in this study. The mean age was 26.5 years. This subjects were allocated by chit method into 2 groups (group A- Therapeutic Ultrasound, mulligan’s pain releasing phenomenon, group B- Therapeutic Ultrasound, Kinesio taping). Before and after the treatment protocol the subjects were assessed for pain by VAS, Grip strength by handheld dynamometer and wrist functional mobility by PRWE scale. These outcome measures were analysed.

Result: Pre and post treatment protocol was analysed by using paired and unpaired t test. Data analysis showed extremely significance for VAS (p=0.0003) and PRWE(p=0.0002) but wasn’t significant for hand held dynamometer (p=0.7759).

Conclusion: The effect of the combination of Ultrasound & Pain releasing phenomenon has extremely significant effect on pain and functional status of wrist than compared to ultrasound and kinesio taping.

Keywords: Pain releasing phenomenon, kinesio taping, Dequervains tenosynovitis

Introduction

In 1895, first time a swiss physician was given credit for describing De-Quervains tenosynovitis condition. It is a disorder that is characterized by pain, tenderness and edema over the radial side of the wrist. In India women had higher rate of dequervains tenosynovitis at 2.8 cases per 1000 person years, compared to men at 0.6 per 1000 person-years(1,2,3).the aetiologies include trauma, Bio mechanical compression, anatomical abnormalities, repetitive micro trauma ,inflammatory disease and increased volume states like during pregnancy.(4)

In the first dorsal compartment of wrist abductor pollicis longus and extensor pollicis brevis tendns placed at the lateral border of the anatomical snuffbox .Inflammation at this place commonly seen in patients who use their wrist and thumbs in a repetitive fashion. So the de quervains tenosynovitis can result from repetitive micro trauma. After occurrence of isolated acute trauma there are chances of inflammation(3,4,5) This condition seen in mother of young children, computer keyboard operators, dentists machinists, golf players, mountain bikers, Sms texters, musicians(6).

In this condition the most standard finding is positive finkelsteins test. The test is performed by asking subjects to make a fist with the thumb enfolded inside the fingers. The therapist stabilizes the forearm and passively performs ulnar deviation. Pain at radial side of wrist, Positive test indicates significantly more pain at radial side of wrist(2).De quervains is diagnosed clinically no need of imaginary findings, x rays are required to evaluate previous distal radius fracture,scaphoid fracture, arthritis of the thumb and bony changes(11) many
authors recommended other investigation techniques like imaging modalities, bone scan, MRI, and ultrasound. If the clinical presentation is clear then no need of other investigations.

De-quervains disease can be treated by operative and non-operative treatment. There is no consensus in the treatment of de’Quervains disease. Some treatments for de’Quervains syndrome include rest, immobilization of thumb and wrist, modalities, analgesics, thumb Spica splint, kinesio-taping, PRP, corticosteroid injection etc. ultrasound is effected at pain site, pain reduces which can facilitate participation in daily activities. In this technique joint compression, muscular contraction or stretch is used to provoke pain stimuli and this stimulus is maintained for 15-20 sec. This technique is indicated when pain will reduce in this time period. As in De-quervains tenosynovitis frenkelstein test which is diagnostically causes pain when tendons are taken in to stretched position. There for stretch PRP mostly chooses for treatment. Brian Mulligan introduced a manual therapy technique for chronic pain management in extremities called as PRP. In this technique joint compression, muscular contraction or stretch is used to provoke pain stimuli and this stimulus is maintained for 15-20 sec. This technique is indicated when pain will reduce in this time period. As in De-quervains tenosynovitis frenkelstein test which is diagnostically causes pain when tendons are taken in to stretched position. There for stretch PRP mostly chooses for treatment.

Kinesio taping works on the hypothesis that it can facilitate the function of muscles and other soft tissues. Although there are many Conventional Physiotherapy interventions available which are successfully incorporated for de’Quervains disease still there is need to find out newer methods of Physiotherapy treatment approaches which can aid in better outcomes, speedy recovery and reducing rehabilitation time.

**Method**

**Population:** The subjects which willing to participate in the study was taken. The criteria for inclusion were: age between 18-40 years and clinically diagnosed with de’Quervains disease. Subjects were excluded if they had history of wrist fracture, severe pain, traumatic hand injury and other musculoskeletal conditions.

30 subjects with the age group 18-40 years, 7 males/23 females participated in this study, written consent form was taken. Subjects were divided into two groups through chit method. Group A 15 received US and PRP other 15 received US and KT. All the subjects were informed about the protocol and gave written consent before their participation. The protocol and the consent form were previously approved by protocol and ethical committee.

**Interventions:** Subjects who clinically diagnosed with the de’Quervains were selected. Considering inclusion and exclusion criteria they were requested to participate in the study. The nature of study and intervention were explained to the subjects and those who were willing to participate were included. Before proceeding to intervention a written consent was taken from subject. A brief demographic data was recorded. By using random sampling method the participants were divided into two groups by chit method; Group A and group B, both groups was received a baseline treatment (Therapeutic Ultrasound) for 1 weeks.

Pre-test values of grip strength, pain and functional mobility was measured by VAS scale, hand grip dynamometer, and PRWE respectively.

**For Both the groups Therapeutic Ultrasound was given in common as a part of the conventional treatment (3Mhz ultrasound set to 1.0 w/cm^2, on pulsed mode for 7 minutes)**

**Group A:** Patient position was sitting. Therapist asked the patient to make the fist with thumb inside the fingers, deviate the wrist medially until the pain was produced. In this method the pain was provoked till the patient can tolerate. The pain was reduced within 15-20 sec, if pain reduces within 15-20 sec, start new PRP in new range with increased force. Therapist should maintain pressure for 15-20 sec at P1 (The point in range of motion were the initial onset of pain is experienced). If the pain does not reduce within 15-20 sec, it indicates that the stretch being applied is too high, hence, the pressure should be reduced to a level so that provoked pain gets reduced within 20 sec. If pain reduces before 10 sec, it implies that stretch being applied is too low. Hence it should be increase to a level so that provoked pain gets reduced within 15-20 sec and not before 10 sec.
**Group B**: The K tape with a width of 5 cm and a thickness of 0.5 mm was selected for this study. First strip placed from the base of the thumb till the mid forearm. Second and third strip have the correction roles. The second strip was placed while the wrist is extended, one end at the dorsum of hand and another end at the distal forearm one inch above the styloid, then by flexing the wrist the tape was fixed. Third tape from the volar side of distal of radius and stretch obliquely to the dorsum of the hand.

After 7 days post-test values was taken. Then by statistical analysis result was calculated.

**Measurement Procedure:**

- **Visual analogue scale (VAS):** Pain was measured in centimetres using the (VAS). Each subject was asked to mark 10 cm. horizontal line to indicate the perceived level of pain intensity when achieve. No pain is indicated with value of 0 cm and extreme pain indicated with a value of 10 cm.

- **Hand held dynamometer:** For measuring the grip strength, the subject asked to sit on the chair with their shoulder joint in a neutral position, elbow fixed at 90°flexion, forearm in neutral and wrist at 0° to 15° radial deviation. The test were perform twice, and the higher value between the two measurement were selected. The measurement unit was kilogram (kg).

- **Patient rated wrist/hand evaluation questionnaire (PRWE):** The PRWE is a 15-item questionnaire designed to measure wrist pain and disability in day to day activities. PRWE allows patients to rate their pain and disability from 0 to 10 and consist of 2 subscales:

  1. Pain subscale: contains 5 items which is rated from 1-10. maximum score of scale is 50 and minimum score of scale is 0.
  2. Function subscale: it contains 10 items which are again divided into 2 sections. Specific activities (6 items) & usual activities (4 items). maximum score of this scale is 50 and minimum 0.

**Result**

Pre and post treatment protocol was analysed by using paired and unpaired t test. Data analysis showed extremely significance for VAS (p = 0.0003) and PRWE (p = 0.0002) but wasn’t significant for hand held dynamometer (p = 0.7759).

**Statistical analysis:** The data was entered into Microsoft office excels 2007 and analysed using instat software. Descriptive statistics were used to analyse baseline data for demographic data. Pre and post treatment protocol was analysed by using paired and unpaired t test and p value less than 0.05 was considered to be statistically significant.

As per the inclusion criteria 30 subjects were included in the study. During 1 week of protocol program 15 subject were in Group A where ultrasound and PRP was given, 15 subjects were in Group B where US and KT was given. Pre analysis was done for 30 subjects. In Table.1 and table 2

<table>
<thead>
<tr>
<th></th>
<th>N = 30 (15 in each group)</th>
<th>Group A</th>
<th>aGroup B</th>
<th>P value</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. VAS</td>
<td>Pre</td>
<td>7.21 ± 1.24</td>
<td>5.6 ± 1.615</td>
<td>0.0048</td>
<td>3.062</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>1.866 ± 0.98</td>
<td>3.466 ± 1.22</td>
<td>0.0003</td>
<td>4.155</td>
</tr>
<tr>
<td>2. Handheld dynamometer</td>
<td>Pre</td>
<td>11 ± 9.33</td>
<td>15.6 ± 8.21</td>
<td>0.1631</td>
<td>1.432</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>23.4 ± 15.63</td>
<td>27.26 ± 15.95</td>
<td>0.7759</td>
<td>0.2875</td>
</tr>
<tr>
<td>3. PRWE</td>
<td>Pre</td>
<td>54.1 ± 16.91</td>
<td>44.06 ± 15.86</td>
<td>0.1049</td>
<td>1.676</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>9.93 ± 3.55</td>
<td>23.83 ± 11.80</td>
<td>0.0002</td>
<td>4.368</td>
</tr>
</tbody>
</table>

Inter group analysis done by using unpaired t test. Pre interventional analysis showed significance for VAS (P = 0.0048) and no significance for handheld dynamometer(p = 0.1631) and PRWE(p = 0.1049) between group A and Group B. Post interventional analysis showed extremely significant for VAS (p = 0.0003) and PRWE (p = 0.0002) but no significant difference seen in handheld dynamometer (p = 0.7759).
Table 2: Intra group analysis comparing pre-pre post-post of each group

<table>
<thead>
<tr>
<th>Group A</th>
<th>VAS</th>
<th>Handheld dynamometer</th>
<th>PRWE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>7.21 ± 1.24</td>
<td>11 ± 9.33</td>
<td>54.1 ± 16.91</td>
</tr>
<tr>
<td>Post</td>
<td>1.866 ± 0.98</td>
<td>23.4 ± 15.63</td>
<td>9.93 ± 3.550</td>
</tr>
<tr>
<td>p value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>T value</td>
<td>23.23</td>
<td>7.105</td>
<td>12.750</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group B</th>
<th>VAS</th>
<th>Handheld dynamometer</th>
<th>PRWE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>5.6 ± 1.615</td>
<td>15.6 ± 8.21</td>
<td>44.06 ± 15.86</td>
</tr>
<tr>
<td>Post</td>
<td>3.466 ± 1.22</td>
<td>27.26 ± 15.95</td>
<td>23.83 ± 11.80</td>
</tr>
<tr>
<td>p value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>T value</td>
<td>11.746</td>
<td>5.650</td>
<td>7.64</td>
</tr>
</tbody>
</table>

Intra group statistical analysis revealed extreme significance (p = <0.0001) between pre and post intervention for both the groups using paired t test. The result shows there is decrease in VAS and PRWE score and improvement in grip strength.

### Discussion

The present study showed out of 30 subjects in the study 76.66% females and 23.33% males were diagnosed with chronic de-quervains. In the study it was found that dominant hand (73.33%) was more affected than non-dominant hand (26.66%). In another study it was stated that de Quervain tenosynovitis was caused by excessive text messaging. (6) This study showed that the age group of 27.86 and 25.86 were more commonly affected because of the excessive mobile use.

The aim of present clinical trial was to compare the effectiveness of KT vs PRP on pain, grip strength and functional mobility of wrist in de’quervains disease.

In the current study commonly used ultrasound as conventional treatment for both the groups as it has been suggested by a study (26) that ultrasound showed benefits with increased local blood flow, pain relief in both acute and chronic pain and increased wound healing.

Paired t test was used to analyze the effect of PRP and showed that there was extremely significant reduction in VAS score (p < 0.0001, t = 23.23), handheld dynamometer (p < 0.0001, t = 7.105) and PRWE score (p < 0.0001, t = 12.750). PRP works on local receptor hysteresis and other centrally mediated endogenous inhibitory systems thus relieves pain and improves function.

Paired t test was used to analyze the effect KT and showed that there was extremely significant reduction in VAS score (p < 0.0001, t = 11.746), handheld dynamometer (p < 0.0001, t = 5.650) and PRWE score (p < 0.0001, t = 7.64). The Kinesio tape lifts the skin and takes pressure off the interstitial fluid provides better drainage and reduce inflammation.(27) KT expands and contracts sensory stimulation in skin during movement or activity stimulates touch receptors activating descending spinal inhibitory system decreasing pain.(1)

Comparison Visual Analogue Scale scores between two groups was done by using one way unpaired test to find out the effectiveness between two groups. The statistical analysis revealed that there was extremely significant difference in visual analogue scale scores in all two groups post treatment (p = 0.0003). Group A was more efficient in reducing VAS scores than Group B in post treatment.

Comparison handheld dynamometer between two groups was done using unpaired t test to find the effectiveness between the two groups. The statistical analysis revealed that there was no significant difference in handheld dynamometer score in two groups post treatment (p = 0.7759). Both the groups were equally efficient in increasing grip strength post treatment.

Comparison PRWE score between two groups was done using unpaired t test to find the effectiveness between the two groups. The statistical analysis revealed that there was extremely significant difference in PRWE score in two groups post treatment (p = 0.0002). Group A was more efficient in reducing PRWE scores than Group B in post treatment.
The result from the statistical analysis of the present study supported alternative hypothesis which stated that there is significant difference between the effectiveness of mulligan’s PRP vs kinesio-taping in De’Quervains tenosynovitis.

It can be stated from above study that both PRP and KT are helpful in reducing the symptoms of De’Quervains tenosynovitis. PRP yields better result outcomes than KT and it is more efficacious and cost effective.

Conclusion

Various conservative approaches are used in treating De quervains tenosynovitis but this study concluded that the PRP with conventional therapy was more effective in decreasing pain and improving quality of life. It is proved from this study that the combination of US and PRP has extremely significant effect on pain and functional status of wrist and thus Alternate Hypothesis that there is significant effect of PRP accepted.

Conflicts of interest: There were no conflicts of interest in this study.

Source of Funding: This study was funded by Krishna Institute of Medical sciences Deemed To Be University, Karad.

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9. Manual Concept of Mulligan; Dr. Depak Kumar, Brian R. Mulligan, 2014


Effectiveness of Myofascial Release and Muscle Energy Technique on Posterior Shoulder Tightness in Overhead Athletes

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ABSTRACT

Background: In overhead throwers, high stress is applied to the shoulder joint due to high forces generated in them thus extra demand on shoulder complex is placed by the overhead athlete. The posterior shoulder tightness (PST) is diagnosed with the decrease of internal rotation and increase in external rotation in the dominant throwing shoulders. So the following study was carried out to improve internal rotation range of motion (ROM).

Objectives:

1. To determine the effect of myofascial release (MFR) on PST in overhead athletes to improve internal rotation of shoulder.
2. To determine the effect of muscle energy technique (MET) on PST in overhead athletes to improve internal rotation of shoulder.
3. To compare the effect of MFR and MET on PST in overhead athletes to improve internal rotation of shoulder.

Method: 200 overhead athletes were screened according to inclusion criteria, out of which 42 fulfilled the criteria. Consent was taken and they were divided into two group. Group A was receive MET and group B receive MFR. The pre and post assessment is taken by using internal rotation ROM and disabilities of the arm shoulder and hand (DASH questionnaire).

Result: In the present study, intra group comparison results showed that internal rotation ROM and DASH questionnaire were statistically significant in both groups. Whereas inter group comparison results showed that MET was statistically significant in improving internal rotation ROM and then MFR in subjects with posterior shoulder tightness, but in DASH score there were no significant difference.

Conclusion: MET showed extremely significant increased in internal rotation ROM than MFR. Both the technique had similar effect on DASH questionnaire in overhead athletes.

Keywords: Posterior shoulder tightness; muscle energy technique; myofascial release; internal rotation range of motion; disabilities of the arm shoulder and hand; glenohumeral internal rotation deficit; overhead athletes

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Introduction

In overhead throwers, high stress is applied to the shoulder joint due to high forces generated in them thus extra demand on shoulder complex is placed by the overhead athlete. For excessive external rotation, the thrower’s shoulder must be lax, but at the same time, it should be stable to prevent symptomatic humeral head subluxation. Hence, it requires a more balance between...
mobility and functional stability. This is called as “the thrower’s paradox”.

Throughout the throwing motion, the glenohumeral joint (GHJ) undergoes extreme range of motion (ROM) velocities and forces in overhead throwing activities. The peak angular velocities nearly reaches 7,000°/s in GHJ internal rotation followed by deceleration at angular velocity of 5,00,000°/s².

Around 17% population with prevalence of shoulder problems is seen during the season of athletic activity. In general, the posterior shoulder tightness (PST) is diagnosed with the decrease of internal rotation and increase in external rotation in the dominant throwing shoulders. It is because of the posterior rotator cuff tightness. PST occurs due to tightness of infraspinatus, teres minor, posterior deltoid.

Glenohumeral internal rotation deficit (GIRD) is defined by “the loss of glenohumeral internal rotation degrees of the dominant shoulder compared with the non-dominant shoulder”. GIRD is also defined by more than 10° to 25° decreased internal rotation ROM in the dominant versus non-dominant shoulder.

Muscle energy technique was developed by Fred L. Mitchell. This technique was classified as an active technique in which the patient voluntarily used his muscles from a precisely controlled position in a specific direction, against a distinctly executed counterforce.

Self myofascial release (SMR), external devices such as foam rollers, massage balls, and j shaped canes have been used in an attempt to improve ROM. SMR has increasingly become popular in the fields of physical therapy, athletic training, and strength and conditioning to treat myofascial restrictions and improve soft-tissue extensibility.

1. Internal rotation ROM

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>‘p’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Median</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>A</td>
<td>61.90 ± 5.79</td>
<td>60</td>
<td>89.80 ± 4.13</td>
</tr>
<tr>
<td>B</td>
<td>62.19 ± 6.81</td>
<td>60</td>
<td>84.04 ± 6.70</td>
</tr>
</tbody>
</table>

In the present study pre-interventional mean of internal rotation range was 61.90 ± 5.79 in Group A and 62.19 ± 6.81 in Group B whereas post-interventional mean of internal rotation range was 89.80 ± 4.13 in Group A and

Materials and Methodology and Procedure

It was a comparative study. The over head athletes coming to Shivaji Stadium at Karad were screened. 200 competitive overhead athletes (i.e. badminton players, cricket bowlers, swimmers) were screened and those fulfilling the inclusion criteria were selected for the study. Inclusion criteria were loss of internal rotation to 10° to 25° of the shoulder compared with non-dominant shoulder. Exclusion criteria was participants under gone any major shoulder surgery before 6 month, previously diagnosed shoulder pathology in their throwing shoulder. Pre-treatment assessment of the willing participate were recorded by an outcome assessor. In the present study out of 42 subjects with PST between age group of 16-30 years were taken. It was a single blinded study in which the pre and post treatment outcome was assessed by outcome assessor. The subjects were then divided into two groups by convenient sampling with random allocation. Group A was with mean age 18.85 ± 3.07 while the group B was with mean age of 18.38 ± 2.5. Group A had given muscle energy technique to shoulder horizontal abductors and external rotators while Group B was given myofascial release to posterior shoulder capsule. The 32 were badminton player and 10 were cricket bowler was taken. The mean duration of play of the participants in Group A was 3.78 year and in Group B was 3.33 year. This was followed by the intervention period of 5 days/week for 2 weeks each techniques was performed for a total of 3 repetitions/sessions were done, followed by which post-treatment outcome assessment i.e. internal rotation ROM and DASH questionnaire was carried out by an outcome assessor.

Data analysis-The statistical analysis of Internal rotation ROM was done by using paired t test and unpaired t test, DASH Questionnaire was done by wilcoxon matched pairs test and mann-whitney test.
84.04±6.70 in Group B. Intra group analysis of internal rotation range revealed statistically increase in internal rotation range in post interventional for both groups. This was done by using paired t test Group A (p<0.0001), Group B (p<0.0001).

2. Disabilities of the Arm, Shoulder, and Hand Questionnaire

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre- treatment</th>
<th>Post-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Median</td>
</tr>
<tr>
<td>A</td>
<td>2.93 ± 2.21</td>
<td>2.5</td>
</tr>
<tr>
<td>B</td>
<td>3.70 ± 3.29</td>
<td>3.33</td>
</tr>
</tbody>
</table>

In the present study pre-interventional mean of DASH score was 2.93 ± 2.21 in Group A and 3.70 ± 3.29 in Group B, whereas post-interventional mean of DASH score was 0.75 ± 1.11 in Group A and 1.12 ± 2.20 in Group B respectively. Intra group analysis of DASH score revealed statistically reduction in DASH scores for both the groups. This was done by using Wilcoxon matched pairs test Group A (p < 0.0001), Group B (p < 0.0001).

Discussion

The incidence of overuse shoulder problems during the training period reported to be 17% in a population of 16-30 years throwing athlete\(^3\),\(^10\). It has also been concluded that there are individuals that participate in activities that require dynamic overhead arm movements such as baseball, softball, volleyball, tennis, badminton and swimming may be at a higher risk of shoulder pathology\(^9\).

In overhead athlete during the arm acceleration phase, large forces are generated by concentric contractions of the internal rotators of the shoulder. In these phases, maximum external rotation occurs to the point of ball release. In acceleration phase, large force absorptions occur due to ball release and follow-through phase. During eccentric contractions of the external rotators, more force absorptions are needed to decelerate the arm after ball release and during the follow-through phase. These deceleration forces place a significant amount of stress on the soft tissues of the posterior shoulder. Due to the repeated deceleration after ball release and during the follow-through, the posterior shoulder capsule, external rotator muscles (infraspinatus, teres minor and posterior deltoid), and connective tissue can develop tightness resulting in decreased internal rotation ROM at the shoulder\(^9\).

GIRD is considered to be “the loss in degrees of glenohumeral internal rotation of the dominant shoulder compared with the non-dominant shoulder”. Since many studies set the criterion for GIRD is 100 to more than 25° loss of internal rotation ROM in the dominant verses non-dominant shoulder\(^6\),\(^7\). In the present study GIRD was 20.45° which support the above study.

So the present clinical trial was conducted to find out the effect of muscle energy technique and myofascial release technique on posterior shoulder tightness in overhead athlete. According to a study done by Stig Haugsoe Anderson et al, 17% prevalence of shoulder problem was seen among 16-30 years overhead athlete\(^3\),\(^10\). Out of 200 overhead athletes, 42 subjects fulfilled the criteria which support the prevalence rate of above study; hence the subjects selected for the present study were 16-30 years competitive overhead athlete.

In the study of Khushboo Bathia, Lalkishan Sewani and Pranjali Sawantdesai\(^12\) glenohumeral internal rotation deficit in asymptomatic collegiate bowlers and badminton players they found out that there was maximum glenohumeral internal rotation deficit seen in cricket bowlers, badminton players. In current study 200 athletes compromising of bowlers (44), badminton players (142), swimmers (14) were taken. But out of 200, 42 fulfilled inclusion and exclusion criteria of which 32 were badminton players, 10 were cricket bowlers, which supports the above study.

42 subjects who were clinically diagnosed with posterior shoulder tightness and fulfilling inclusion and exclusion criteria with the age group between 16-30 years were included in the study. They were allocated in two groups, Group A and Group B, each containing 21 subjects.
The muscle energy technique in which post isometric relaxation was given to the shoulder horizontal abductor and external rotators to Group-A and self myofascial release to the posterior shoulder capsule by the use of tennis ball was given to Group B. The outcomes were measured by: internal rotation ROM by universal goniometry and shoulder disabilities and function by DASH.

The average mean age of participants in Group A was 18.85 ± 3.071 and in Group B was 18.38 ± 2.5, which showed there is no significant difference in age of the subjects in both the groups (t = 0.5477, p = 0.5870). The total numbers of participants included were 42 out of which 28 were males and 14 were females. Group a contained 16 males and 5 females whereas group B contained 12 males and 9 females. Out of 42, 32 subjects (Group A = 16, Group B = 16) were badminton players and 10 subjects (Group A = 5, Group B = 5) were cricket bowlers.

Paired ‘t’ test was used to analyze the effect of muscle energy technique on posterior shoulder tightness and showed that there was extremely significant improvement in internal rotation range of motion (t = 21.526, p < 0.0001) and DASH score (r = 0.6282, p < 0.0001).

Muscle energy technique was used to lengthen shortened muscle and strengthen weakened muscles. In the MET, the affected muscles (agonist) were used in the isometric contraction; therefore the shortened muscles subsequently relax via post-isometric relaxation, allowing an easier stretch to be performed. The therapist reaches towards the barrier of restriction, against patients counter-force. This helped in improving range of motion and DASH scores. Increase in range of motion and reduction of DASH score helped in improving flexibility of the posterior shoulder muscles. Hence, the muscle energy technique helped to decrease posterior shoulder tightness in overhead athlete. This supports the study of Stephanie d. Moore, Kevin G. Laudner, Todd A. Mclooda et al. the immediate effects of muscle energy technique on posterior shoulder tightness.

Paired ‘t’ test was used to analyze the effect of myofascial release on posterior shoulder tightness which showed that there was extremely significant improvement in internal rotation ROM (t = 14.861, p < 0.0001) and DASH score (r = 0.4810, p < 0.0001).

SMR has become increasing popular in the fields of physical therapy, athletic training, and strength and conditioning to treat myofascial restrictions and improve soft-tissue extensibility. In which, principles of biomechanical loading of soft tissue and stimulation of mechanoreceptors in the muscles, tendons, and fascia were included. The stimulation of these mechanoreceptors results in autogenic inhibition, which stimulates the Golgi tendon organ (GTO) and it inhibits the muscle spindles in the muscles. The GTO, along with other interstitial receptors and Ruffini endings throughout the fascia, respond to tension. Applying static myofascial tension will activate these receptors, thus inhibiting the muscle spindles and allowing the muscles to relax. MFR is performed by applying gentle and sustained pressure to a tender area in the fascia, while maintaining the position and load until the tissue responds by relaxing and allowing the fascia to release. Increase in range of motion and reduction of DASH score help in improving flexibility of the posterior shoulder muscles. Hence, myofascial release helped to decrease posterior shoulder tightness in overhead athlete.

Comparison of internal rotation ROM between two groups was done by using unpaired ‘t’ test to find out the effectiveness between two groups.

The statistical analysis revealed that there was very significant difference in range of motion in both the groups. Group A was more efficient in improving the internal rotation of shoulder (p = 0.0018) than Group B post treatment.

Comparison of DASH score between two groups was done using unpaired ‘t’ test to find the effectiveness between two groups.

The statistical analysis revealed that there was no significant difference in DASH score in both the groups. Group A was more efficient in improving the internal rotation range of motion (p=0.9288) than Group B post treatment.

The result from the statistical analysis of the present study supported alternative hypothesis which stated that there will be beneficial effect to the subjects treated with muscle energy technique to improve range of motion.

Post-isometric relaxation was effective in present study because the affected muscle that is agonist are used in the isometric contraction, therefore the shortened muscles relax and strengthens via post isometric relaxation, but in the myofascial release the
affected muscles only gets relaxed via stimulation of mechanoreceptors.

Hence, above result showed that the participants treated with muscle energy technique showed better increase in range of motion and decrease DASH score in posterior shoulder tightness.

Thus, it can be stated from the above study that muscle energy technique and myofascial release are more efficacious and cost effective.

**Conclusion**

This study concluded that both the groups showed significant improvement in internal rotation ROM and reduction in DASH score. MET showed extremely significant increased in internal rotation ROM than MFR. Both the technique had similar effect on reducing symptom & improving functional ability in overhead athletes.

**Conflicts of Interest:** This study can be carried out with longer duration and chronic GIRD with shoulder injuries can also be taken into consideration.

**Ethical Clearance:** Ethical clearance was taken from institutional committee of Krishna institute of medical science, deemed University, Karad.

**Source of Funding:** Source of funding is Krishna institute of medical sciences deemed University, Karad.

**REFERENCES**


A Study of Socio-Demographic Factors Effecting under Nutrition in Under Five Children of Slum in Mysuru—An Exploratory Study

Krishnaveni ys¹, Meghana Narendran¹, Prakash B², Narayanamurthy MR³
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ABSTRACT

Background: Malnutrition not only reflects health of children but it also represents the socioeconomic, demographic and psychological features of the family.

Objective: To determine Socio-demographic factors effecting Under nutrition in under five children of slum area, Medhar block

Method: An Exploratory study conducted in urban slum from August 9th to October31st 2017. 10 Anganwadi workers and helpers were interviewed about malnourished children in their areas. 94 mothers of were randomly selected and interviewed about their antenatal and perinatal care. Anthropometric examination of 64, 1-5 years children was done. Focus group discussion done among 22 mothers and details of diet given to children were discussed. Data collected were compiled, anthropometric data entered in excel and WHO anthro and association with other factors were analyzed using chi-square tests, and t test in SPSS 24.

Result: Under nutrition seen in 30% of under five children. Stunting in 34% and wasting in 14%. Stunting associated with antenatal weight gain (P 0.02) and birth weight (P 0.04). Wasting associated with age of mother at pregnancy and birth weight. 16% of mothers delivered low birth weight babies and 17% of them stopped breast feeding before 1 year. Nutrition provided to children were inadequate.

Conclusion: Awareness on antenatal care, exclusive breast feeding, supplementary food and adequate nutritious diet for children needs to be strengthened. Health workers should be trained regarding communication and health education, so that they convey proper knowledge to mothers.

Keywords: Under five, stunting, wasting, antenatal care, perinatal care

Introduction

Under nutrition is defined as the outcome of insufficient food intake and repeated infectious diseases. It includes being underweight for one’s age, too short for one’s age (stunted), dangerously thin for one’s height (wasted) and deficient in vitamins and minerals (micronutrient malnutrition). ¹It is explained in terms of ‘stunting’ & ‘wasting’. Stunting is failure to grow both physically and cognitively, resulting due to chronic or recurrent malnutrition. Moderate and severe stunting is defined as 0 to 59months children who are below-2SD from median height-for-age of WHO child growth standards. Wasting (acute malnutrition) is a result of recent rapid weight loss or failure to gain weight. Moderate wasting is defined as 0-59 month’s children below -2SD from median weight-for-height and severe as below -3SD. ²Globally 154.8 (142.7-166.9) million are suffering from stunting which accounts for 22.9% of total under five population. Moderate wasting is seen in 51.7(43.6-57.9) million and severe in 16.9(13.3-20.9) million children accounting for 7.7% and 5.2% respectively. In South Asian regions stunting seen in 35.8(33.3-38.5) %; moderate wasting in16 (13.4-19.1)
% and severe wasting in 5.2(4-6.6) % of 0 to 5 years children. In India it is comparatively more with 38.4% children below five years being stunted, 21% with moderate wasting and 7.5% severe wasting.3

Under nutrition puts children at greater risk of dying from common infections, increases the frequency and severity of such infections and contributes to delayed recovery.4 Malnutrition not only reflects health of children but it also represents the socioeconomic, demographic and psychological features of the family.5 Dealing with under nutrition needs addressing the hidden causes like maternal health, maternal knowledge of child care, family turmoil and overall imbalance in the family. Though there are many studies on prevalence of malnutrition and factors associated with it, details of family problems contributing to malnutrition is lacking. To explore those causes study was conducted in high-risk area (settled slum) of our field practice area. Medar block to assess factors effecting Under nutrition in under five children of slum area.

**Materials and Methodology**

An Exploratory study was conducted in field practice area of JSS Medical College, Medhar block (ward 42, Mysuru) from August 9th to October 31st 2017. Ethical clearance was taken from the institutional ethical committee. Study was conducted through interviews and focus group discussions (FGD). In all 5 Anganwadis of the area, 5 workers and 5 helpers are interviewed in depth regarding moderate and severe malnutrition among 1 to 5 years children after taking informed consent. Each interview was done for 20 minutes through open ended questions. Based on prevalence of under nutrition of 31.5%, α 0.05, β 20, absolute precision 10 and non-response rate of 10%, a sample size of 94 was calculated. 94 Mothers of under five children were randomly selected in the area, informed consent taken and interviewed through pre-structured questionnaire about age at time of pregnancy, antenatal care, perinatal care and infant care of children. Among the under five children of these 94 mothers 64 were purposively selected were examined after taking informed consent from mothers, to assess malnutrition through height, weight and mid-arm circumference. Children with congenital anomalies and chronic illness were excluded. Focus group discussion conducted in anganwadi among 30 mothers in 4 divided groups, about feeding practices in children. Questions regarding amount and frequency of food given to children, Use of green leafy vegetables, fruits, sprouted grains egg and non vegetarian food, frequency of using them were discussed. And also myths and faddism related to foods were discussed. Discussion was recorded and noted. Data collected were compiled, anthropometric data entered in excel and WHO anthrop and Z scores were calculated for height for age, weight for height and mid arm circumference. Association with other factors were analyzed using chi-square tests, odds ratio and t test in SPSS 24.

**Findings**

Results were obtained from compiling the data of interviews of anganwadi workers, mothers, anthropometric assessment of under-five and Focus group discussions. Medhar block is a settled high-risk area containing 6 blocks, 5 anganwadis catering a population of 6400 covering 254 under five children, among whom 85 children were present in anganwadi centers. Only 2 children were severely underweight and 24 were moderately undernourished. (Table -1) Anganwadi workers said “most of the parents send their children to private babysitting, so children attending anganwadis are low” and nutrition day is conducted once in a month in all anganwadis, reason given by workers is that “parents don’t attend mother’s meeting or nutrition day as they go for daily wages and have work at home.” Anganwadi helpers also said that food provided for pregnant women are shared among whole families.

Among 94 participants 62% had gained more than 10kgs during abential period, 48% gained less than 10kgs, 21% had ANC complications during 3rd trimester of pregnancy and delivered by c-section, 16% delivered low birth weight babies. 82% of them breastfed their babies adequately and 17% of them stopped breast feeding before 1 year. Among the 64 children examined, 30% were undernourished (according to IAP classification) with 22% moderate and 8% severely undernourished. 14% of children had wasting with 2% severely wasted. Stunting was seen in 34% of children. Z scores of weight-for-age, weight-for-height and height-for-age were less compared to WHO standards for India. Stunting was seen significantly more in males than females (p 0.05: OR 0.355, 95% CI 0.1-1.05), in children whose mother had weight gain lesser than 10kg in their ante-natal period (P 0.02: OR 0.21, 95% CI 0.54-0.83) and in children with lower birth weights (P 0.04; t 2.01, 95% CI 1.39-553.6). Mean weights of children was lower in stunted children than normal children (P<0.01; t 3.09, 95% CI 0.69-3.24). Wasting was found significantly associated with age at pregnancy (P 0.04; t 2.023 95% CI 0.01-2.63) and birth weight of the children.
In focus group discussion 30 mothers participated. Mean age was 31.5 years. 79% had 2 children and 21% had single child. 90% were literates, all belonged to lower socio-economic class. 2 among the participants were pregnant for second child. Common breakfast given to children were cereals based, any one of 1 chapathi/1 dosa /2 idles /1cup upma /1cup rice diets, 1 rotis. 2 mothers said they gave rotis prepared from flour of different pulses that is wheat, red gram, green gram, black gram. 95% of them gave rice and sambar for dinner every day and for lunch when there is holiday for anganwadis. They used about 50grams of pulses for whole family per day for cooking. Green leafy vegetables and other vegetables were used as ‘palya’ only with chapattis and rotis and rarely with lunch and dinner. Egg was given to children twice or once weakly but yolk is discarded thinking it causes indigestion. Chicken was given once in a weak in non-vegetarian families, Meat and fish was given once in fortnight. Three mothers gave fish twice weekly and were avoided by many. One glass of milk was given to child twice daily after diluting with water. Only one mother gave 4 glasses of milk daily. (Table 2) Among fruits apple, banana and grapes were given which were brought once in 15days two pieces given every day. Locally available fruits like guava were avoided thinking that it causes upper respiratory infection. All fruits were avoided during fever and other illness. Sprouted grains were given as sambar rarely about twice or thrice monthly. Sugar was used by 95% of mothers and 5% used jaggery. Regarding use of Oils 100% used sunflower oil about 3 to 5liters/month. Oil fried snacks were used at evening time with beverages most of the days, 5 to 6 days in a weak. Three mothers gave biscuits to children during snack time. Chips and other fried snacks available at shops were allowed to eat by children whenever they were asked for. Taboos like avoiding eggs, papaya and other fruits during pregnancy and lactations are practiced by 81% families. Also sesame, vegetables like ladies finger, cluster beans fruits like banana and guava and ghee are avoided. Awareness on contraception was 40%. 83% of them said there is no relation between food intake and disease ,remaining said that it may cause anemia, decrease strength decreased white blood cells and reduced growth. They feel that the food which they are providing to their children is sufficient and no changes needed. They also said they have to spend more money for nutritive food.

**Table 1: Details of anganwadis in the area**

<table>
<thead>
<tr>
<th>Anganwadis</th>
<th>1ST</th>
<th>2 ND</th>
<th>3 RD</th>
<th>4 TH</th>
<th>5 TH</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population covered</td>
<td>1450</td>
<td>1600</td>
<td>1200</td>
<td>1350</td>
<td>800</td>
<td>6400</td>
</tr>
<tr>
<td>Total under five children in area</td>
<td>62</td>
<td>68</td>
<td>45</td>
<td>48</td>
<td>31</td>
<td>254</td>
</tr>
<tr>
<td>3-6years attending anganwadis</td>
<td>20</td>
<td>30</td>
<td>10</td>
<td>15</td>
<td>10</td>
<td>85</td>
</tr>
<tr>
<td>Moderately undernourished</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>Severely undernourished</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Parents meetings conducted</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nutrition days observed/year</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

**Table 2: Nutritional intake of childrens as per focus group discussion**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Daily</th>
<th>Twice weekly</th>
<th>Once weekly</th>
<th>Twice monthly</th>
<th>Once monthly</th>
<th>Reasons given</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>33%-4times; 46%-2times; 26%-once</td>
<td>33%-4times; 46%-2times; 26%-once</td>
<td>Diluted and used</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egg</td>
<td>-</td>
<td>66%</td>
<td>07%</td>
<td>17%</td>
<td>10%</td>
<td>Yolk not given as it causes indigestion</td>
</tr>
<tr>
<td>Chicken/mutton</td>
<td>-</td>
<td>-</td>
<td>67%</td>
<td>30%</td>
<td>-</td>
<td>Chicken used more</td>
</tr>
<tr>
<td>Fish</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>06%</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>sprouts</td>
<td>-</td>
<td>14%</td>
<td>23%</td>
<td>10%</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td>Green leafy vegetables</td>
<td>-</td>
<td>70%</td>
<td>10%</td>
<td>13%</td>
<td>7%</td>
<td>Only with chapatti/rottis or sambar</td>
</tr>
<tr>
<td>Roots &amp;tubers</td>
<td>Rarely – carrots , beetroots</td>
<td>Used mostly with Palav/sambar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil/ghee</td>
<td>47% - 2lts/month; 33% -3lts/month ; 20% -1lts/month ;7% -5lts/month;</td>
<td>sunflower oil only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discussion

Stunting is seen in 34% and wasting in 14% of children which is similar to NFHS-4 report of 35.7%. Malnourishment also found in antenatal period suggested by low birth weight and less weight gain in mothers. Adequate nutritional awareness is lacking in mothers.

A study done by SS Yadav I Haryana shows relation of nutritional status with sociodemographic features and maternal education and working status. Another study by purohith et al in Maharasstra also shows association of malnutrition with mother’s education along with birth weight and birth order. Similar finding was also in present study where birth weight is associated with stunting. Focus group discussion revealed poor knowledge and practice regarding contraception and nutrition. This explains antenatal undernourishment; poor weight gain, and increased births that will impact nutritional status of children. Study by Mahama saaka relates knowledge of mother and stunting. There is lack of knowledge in mothers of present study also and stunting is comparatively more than wasting. Rachel Browne in his study describes correlation between parents attempt to control child’s diet and increased intake of snacks. FGD in present study also conveys increased junk food intake which mothers themselves unable to control. In a Japanese study by Keiko Asakura, increased guardian food knowledge increased vegetable intake in children. This suggests need for food education programmes which benefits urban slums. Cross-sectional study by shannon M et al shows food taken by children outside child care contained more than recommended calories and was deficient in fruits, milk and vegetables recommended.

Conclusion

Wasting seen in 14% and stunting in 34% of children. Under nutrition is also seen in mothers during their antenatal, perinatal and postnatal periods. Awareness on antenatal care, nutrition in antenatal period, exclusive breast feeding, weaning and supplementary food, needs to be strengthened. Though mothers know what is nutritious food, how much and how frequently to be given are not known. There is a lack of interaction between health workers and mothers. Detailed education to be given to mothers about preparing nutritious foods from locally available, affordable ingredients. These to be dealt with in regular meetings at anganwadis and workers should be trained regarding communication and health education, so that they convey proper knowledge to mothers. Observing Nutritional days to be encouraged and specific and detailed topics need to be discussed and demonstrated.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: Taken

REFERENCES

8. Saaka M. Relationship between Mothers’ Nutritional Knowledge in Childcare Practices and the Growth of Children Living in Impoverished


Treat the Troika: Does Depression and Malnutrition affect Activities of Daily Living?—A Study among Elderly Soliga Tribes, B. R. Hills, Karnataka

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¹Postgraduate, ²Associate Professor, ³Assistant Professor, ⁴Professor, ⁵Professor and Head of the Department, Department of Community Medicine, JSS medical College, Mysuru

ABSTRACT

Background: Tribal population in India are the most underprivileged and their problems depend on their remoteness from the rest of the communities. Among them, elderly are often deprived of nutritional and health care facilities and also depression many times be undiagnosed or misdiagnosed.

Objective: To assess the Socio-demographic profile, Depression, Nutritional status and Activities of daily living (ADL) among elderly.

Method and Methodology: This cross-sectional study was done in all the five tribal hamlets of Biligiriranga Hills, Karnataka for a period of two months. A pretested semi-structured interview schedule was used to collect details regarding socio-demographic characteristics and standard questionnaires like Standard of Living Index, Geriatric Depression Scale, Mini Nutritional Assessment and Katz Index of Independence in ADL. All persons 60 years and above residing in the house were included for study, the sample size was total of 132 participants.

Result: Among the study participants 59 (44.7%) males and 73 (55.3%) females. Forty one (31.1%) belonged to low SLI, 18 (13.6%) were suggestive of Depression, 77 (58.3%) were at Risk of Malnutrition and 31 (23.5%) were Malnourished. Forty five (34.1%) were underweight and 7 (5.3%) had decreased ADL.

Conclusion: The study showed increased risk for elderly malnutrition and most of them are underweight and few are suggestive of depression. There is a need for geriatric clinic that can take care of their physical and psychological needs and this together has a significant impact on their quality of life.

Keywords: Geriatric, Soliga tribes, depression, malnutrition.

Introduction

Ageing is a natural process that begins at birth, or to be more precise, at conception, a process that progresses throughout one’s life and ends at death. Aging of population is an end product of demographic transition. The number of elderly people in developing countries is almost 3-4 times of that of developed countries. The developed countries have already experienced the consequences of this transition.¹ With increasing life expectancy, the proportion of elderly population is fast increasing. Aging is inevitable and irreversible. The epidemiology and the clinical features of diseases vary in this age group. Tribal population in India are the most underprivileged population and among them, elderly are more often deprived of health care facilities. India’s elderly population in 2011 census was contributing to 8.2% of the total population,² Adivasi makes up 8.6% and 6.95% of India’s tribe reside in Karnataka. The Soliga tribes inhabit the Biligiriranga (BR) Hills which is situated in south-eastern Karnataka, at its border with Tamil Nadu (Erode District) in South India. The Soliga speak Sholaga, which belongs to the Dravidian family. A scheduled tribe, they have a population of around 20,000 individuals.³ It is noted that Soligas maintained

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a continuous and intimate interaction with the forest, deriving most of their basic requirements from the forests. Due to their intimacy with the nature, the Soligas have a holistic outlook on life and their indigenous knowledge is also holistic in nature. Tribal’s have poor access to health services and there is also under utilization of health services owing to social, cultural and economic factors. Among the various health problems of the tribe, data on the prevalence of depression and malnutrition is lacking in many regions of the country. Depression, along with other mental health disorders, has long been segregated and neglected. Depression is under treated in elderly age group, and perhaps particularly so because it is not yet perceived as a priority public health problem in developing countries. On the other hand, Malnutrition in elderly people is very common because daily food consumption decreases with old age. Studies have shown that more than 50% of the older population are underweight. Nutrition deserves special attention as people reach older age because good nutrition is essential for good health. Healthy ageing is associated with a number of physiological, cognitive, social and lifestyle changes that influence dietary intakes and nutritional status. Access to and consumption of healthy food for older people is influenced by the wider determinants of health. These determinants include cultural, social, historical and economic factors. Therefore, the current study was primarily aimed to assess the prevalence of depression and malnutrition and its impact on activities of daily living among elderly Soliga tribes.

Materials and Methodology

A Community based Cross Sectional Study was done among 132 elderly Soliga tribes in Biligiriranga hills, Chamarajanagar district, for a period of 2 months. All the 5 tribal hamlets at Biligiriranga hills namely Biligiri Podu, Bangle podu, Seege betta, Hosapodu and Kanneri colony were included in the study. Starting from the first house numbered in each hamlet, House to House visit was made and all persons 60 years and above residing in the house and who gave oral consent were included for study. The sample size was total of 132 participants and persons with Stroke with Aphasia, Loss of Hearing and those who are affected with loss of memory and the individuals who were not present at their house even after three visits were excluded from the study.

Socio-demographic information was collected (age, gender, education, occupation, income, marital status, type of family, Standard of Living Index), History of existing Medical Illness were documented. Blood Pressure recording for all subjects using standard method. Geriatric Depression Scale (Short Form) to estimate prevalence of depression. Mini Nutritional Assessment (MNA) Questionnaire was used to estimate prevalence of malnutrition and Katz Index of Independence to assess ADL. Anthropometric measurements were obtained (i.e. height, weight). Data obtained were entered in EpiData sheet. Descriptive statistical measures like percentages were used for qualitative data and quantitative data were expressed as mean and standard deviation. Appropriate statistical tests and Inferential Statistics were applied as needed. SPSS Version 22 software were used for statistical analysis. The differences and association were expressed statistically at p-value less than 0.05

Table 1: Socio-demographic characteristics of study subjects (N = 132)

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Years</td>
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<td></td>
</tr>
<tr>
<td>60-69</td>
<td>75</td>
<td>57</td>
</tr>
<tr>
<td>70-79</td>
<td>33</td>
<td>25</td>
</tr>
<tr>
<td>80 &amp; above</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>59</td>
<td>44.7</td>
</tr>
<tr>
<td>Female</td>
<td>73</td>
<td>55.3</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>92</td>
<td>69.7</td>
</tr>
<tr>
<td>Primary</td>
<td>31</td>
<td>23.5</td>
</tr>
<tr>
<td>Middle</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>Higher sec</td>
<td>3</td>
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</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>127</td>
<td>96.2</td>
</tr>
<tr>
<td>Unmarried</td>
<td>5</td>
<td>3.8</td>
</tr>
<tr>
<td>Type of family</td>
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<td></td>
</tr>
<tr>
<td>Joint</td>
<td>6</td>
<td>4.6</td>
</tr>
<tr>
<td>Three generation</td>
<td>5</td>
<td>3.8</td>
</tr>
<tr>
<td>Nuclear</td>
<td>38</td>
<td>28.8</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Table 2: Distribution of Study participants based on SLI and Habits

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard of living Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low SLI</td>
<td>41</td>
<td>31.1</td>
</tr>
<tr>
<td>Medium SLI</td>
<td>91</td>
<td>68.9</td>
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</table>
Table 2 conted...

**BPL card**

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
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</tr>
</thead>
<tbody>
<tr>
<td>121</td>
<td>81.2</td>
<td>11</td>
</tr>
<tr>
<td>7.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Medical Insurance**

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>123</td>
<td>93.1</td>
<td></td>
</tr>
</tbody>
</table>

**Tobacco Consumption/Habits**

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Smiling tobacco</th>
<th>Chewing tobacco</th>
<th>Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td>93</td>
<td>70.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>8.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Distribution of study subjects based on prevalence of Depression, Malnutrition, Activities of Daily Living and Obesity

<table>
<thead>
<tr>
<th>Variables category</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>114 (86.4)</td>
</tr>
<tr>
<td>Suggestive of Depression</td>
<td>18 (13.6)</td>
</tr>
<tr>
<td>Nutritional Status</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>24 (18.2)</td>
</tr>
<tr>
<td>At risk of malnutrition</td>
<td>77 (58.3)</td>
</tr>
<tr>
<td>Malnourished</td>
<td>31 (23.5)</td>
</tr>
<tr>
<td>KATZ ADL</td>
<td></td>
</tr>
<tr>
<td>Normal ADL</td>
<td>125 (94.7)</td>
</tr>
<tr>
<td>Low ADL</td>
<td>7 (5.3)</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>45 (34.1)</td>
</tr>
<tr>
<td>Normal</td>
<td>60 (45.5)</td>
</tr>
<tr>
<td>Overweight</td>
<td>12 (9.1)</td>
</tr>
<tr>
<td>Obese I</td>
<td>13 (10.3)</td>
</tr>
</tbody>
</table>

Table 4: Distribution of study subjects based on Association between Gender and Literacy level with Nutritional Status and BMI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gender (n = 132)</th>
<th>Education (n = 132)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional status</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Normal</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>At risk</td>
<td>36</td>
<td>41</td>
</tr>
<tr>
<td>Malnourished</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>59 (44.7)</td>
<td>73 (55.3)</td>
</tr>
<tr>
<td>P value*</td>
<td>7.684 (&lt;0.021)</td>
<td>8.565 (0.014)</td>
</tr>
<tr>
<td>BMI</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Under weight</td>
<td>8</td>
<td>37</td>
</tr>
<tr>
<td>Normal</td>
<td>34</td>
<td>26</td>
</tr>
<tr>
<td>Overweight</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Obese I</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>73</td>
</tr>
<tr>
<td>P value</td>
<td>23.940 (&lt;0.001)</td>
<td>18.234 (&lt;0.001)</td>
</tr>
</tbody>
</table>

Numbers in brackets indicate column percentage.

*Fisher’s exact test.
Table 5: Distribution of study subjects based on Association between Fuel used for cooking and Nutritional Status and BMI

<table>
<thead>
<tr>
<th>Category</th>
<th>Fuel for cooking</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LPG</td>
<td>Wood fire</td>
</tr>
<tr>
<td>Nutritional status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>At risk</td>
<td>48</td>
<td>29</td>
</tr>
<tr>
<td>Malnourished</td>
<td>22</td>
<td>9</td>
</tr>
<tr>
<td>Total (%)</td>
<td>76(57.6)</td>
<td>56(42.4)</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>32</td>
<td>45</td>
</tr>
<tr>
<td>Normal</td>
<td>37</td>
<td>60</td>
</tr>
<tr>
<td>Overweight</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Obese I</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Total (%)</td>
<td>76(57.6)</td>
<td>56(42.4)</td>
</tr>
</tbody>
</table>

*Fisher’s exact test.

Table 6: Distribution of study subjects based on Association between Activities of daily living and Depression

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>GDS</th>
<th>Total (%)</th>
<th>Chi</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Normal</td>
<td>Suggestive of depression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KATZ ADL</td>
<td>Normal ADL</td>
<td>110</td>
<td>15</td>
<td>125</td>
<td>94.7</td>
</tr>
<tr>
<td></td>
<td>Low ADL</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>114</td>
<td>18</td>
<td>132</td>
<td></td>
</tr>
</tbody>
</table>

Results

The mean age of the study population was 71 years ± 7 SD. (Table 1). About 91 (68.9%) belonged to medium Standard of Living index (SLI). About 84 (63.6%) of them had inadequate ventilation inside their house whereas 48 (36.4%) had adequate ventilation. Among the study participants, about 46 (34.8%) of them did not have toilet facility of their own and they go to fields for defecation, whereas about 86 (65.2%) have their own pit in their house. About 11 (7.4%) had no BPL card and 123 (93.1%) did not have any medical insurance. There were 39 (29.6%) participants who had habits of smoking and alcohol, among which 25 (19%) smoked tobacco, 11 (8.3%) chewing tobacco and 3 (2.3%) consumed alcohol.

(Table 2). Among the study participants, 18 (13.6%) were suggestive of Depression, 77 (58.3%) were at Risk of Malnutrition and 31 (23.5%) were Malnourished. About 45 (34.1%) were underweight and 7 (5.3%) had decreased Activities of Daily Living (ADL). (Table 3). It was seen that females (p value 0.02), and non-Literates (p value 0.01) where more at risk of malnutrition when compared to males which was found to be statistically significant. It was seen that females (<0.001) and non-Literates (<0.001) were found to be underweight when compared to males which was found to be statistically significant. (Table 4).

It was found that people who used LPG were more at risk of malnutrition, malnourished (<0.001) and underweight (<0.001) when compared to those who used wood fire. This was with respect to the expenditure to procure LPG was higher and accordingly their food consumption was reduced in comparison with wood fire which was cost effective. (Table 5).

It was seen in this study that higher the depression lesser is the activities of daily living (p value 0.02) and which found to be statistically significant. (Table 6).

Discussion

In the present study the majority were females 73 (54.3%) than males 59 (44.7%) in comparison to a study which showed vast majorities (56 per cent) of the respondents are males and remaining 44 per cent of them are females.8
When the educational status of the elderly respondents was analysed, it was found that there were 92(69.7%) non-literate, and 31(23.5%) primary level and only 3(2.3%) had their higher education when compared with a study wherein, there were more of non-literate (88 per cent), and a few of the (12 per cent) respondents completed only primary level education. It was observed that most of the respondents were uneducated due to non-availability of school in the study area for the past few decades.8

It is found that 80% of the tribal population were living in kutcha houses which was found similar to a study wherein, 78 per cent of tribal people are living in huts or Thatched house at interior forest area, 20 per cent of the respondents residing at Pucca house these types of houses are made up of sand, stone, wood and leaf, and remaining 2 per cent of the respondents are living in concrete house.8

Almost 50% of the tribal elderly reported that the doctors were not present in the PHC(nearest 20 kms away) most of the time which was similar to a study done by Santhosam MA et al.9 Previous studies show that almost 20% of the PHCs in tribal areas are not staffed with doctors (15% in non-tribal areas) and 15% of the posts for paramedical workers are vacant.10,11

Tribal people often use home remedy or indigenous medicines for their ailments as the first preference. For them, seeking medical services is expensive unless it is from a government hospital. The elderly tribal generally are the last in a household to seek or to demand the medical aid. Their inability to pay for their treatment is a major problem. Another major problem is that they have the habit of getting treatment always free and the major reason quoted was poverty and their family not willing to pay for their health problems. Most of the elderly could not gain access to medical care services due to under-developed communication and lack of transport facilities.

The prevalence of malnutrition was found to be very significant where about 77(58.3%) were at risk of malnutrition and 31(23.5%) were malnourished which was almost similar to a study where the prevalence of Chronic Energy Deficiency (CED = BMI < 18.5) was relatively higher (65.4%) in females compared with their male counterparts (61.8%). The tribal elderly are subsisting on inadequate diets, which are reflected in the poor intakes of all the nutrients and higher prevalence of undernutrition.12 A community based study on nutritional status of the Jenu Kuruba tribes of Mysore district, the overall prevalence rates of underweight, stunting and wasting were found to be 38.6, 36.8 and 18.6 per cent,13 respectively among under 5 year children which shows that health was neglected from the growing stages of life.

Though in various parts of the world revealed that the median prevalence rate of depressive disorders in the world was determined to be 10.3% and among the Indian elderly population was found to be 21.9%14 but there are not much studies done on prevalence of depression among elderly tribal population. This present study showed 18(13.6%) of them were suggestive of having depression with the reasons of not getting adequate care by their family members and due to financial constrains and inability to earn on their own were the reasons for their depression.

A study done by Payghan BS in Chitradurga tribe using GDS scale, showed prevalence of depression was 41.7 %. Geriatric depression showed statistically significant association with advancing age, widowed, financially dependent, living in joint families and those who felt neglected.15

**Strengths and Limitations of study**

The present study used Standardized and validated Geriatric Depression Scale (Short form) to assess Depression among elderly tribes and Mini Nutritional Assessment (MNA) tool to assess nutritional status and Katz Index of Independence to assess ADL. Limitations of study is the inherent recall bias could not be eliminated. Comparison between various studies shows many findings close to the present observations but the evaluation tool are different for most of studies and also as each tribal population had varied ethnicity and therefore, generalization of the present result is not possible.

**CONCLUSION AND RECOMMENDATION**

The results of the study showed that there is an increase risk for elderly malnutrition and most of them are underweight and few of them are suggestive of depression. Those most at risk for developing malnutrition and depression are those who lack food access because of poverty, their isolation from society,
disability resulting from chronic geriatric disease, or due to combination of these factors.

The promotion and implementation of low cost, prevention-based initiatives such as health, nutrition, and physical education, could significantly enhance the possibility of maintaining good mental and nutritional status for the elderly. There is also a need for more number of health workers who can take care of their physical and psychological needs and this together has a significant impact on their quality of life.

**Ethical Clearance:** Ethics clearance was taken from institutional ethics committee

**Source of Funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


Effect of PNF Stretching and Foam Rolling Exercises in Patellofemoral Pain Syndrome

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¹Physiotherapist, ²Assistant Professor, ³Physiotherapist, Faculty of Physiotherapy, Krishna Institute of Medical Sciences ‘Deemed to be’ University, Karad, Maharashtra, India

ABSTRACT

Background: Patellofemoral pain is usually experienced by active young individuals which is usually experienced at the front and around the knee and increases with repeated knee movements. Factors such as lower limb malalignment and muscle dysfunction will cause patellar maltracking leading to tension or compression of soft tissue structures which will consequently hamper functional activities.

Objective: To compare the effect of PNF stretching and foam rolling exercises in patellofemoral pain syndrome.

Method: 40 subjects positive for patellar grind test between the age group of 16-40 years were randomly allocated to receive PNF stretching (Group A) and Foam rolling exercises (Group B) along with common strengthening exercises. The intervention period was of 6 days/week for 4 weeks. Pre and post treatment assessment was taken using VAS, knee ROM, KPRS and Q angle.

Results: Both the interventions significantly improved pain relief, knee ROM, KPRS scores and Q angle post treatment within the groups whereas the intergroup analysis showed significant difference in pain relief, knee ROM, and KPRS scores between groups but no significant difference was found in Q angle.

Conclusion: Both PNF stretching combined with strengthening exercises and Foam rolling exercises combined with strengthening exercises were effective in improving pain relief, knee ROM, KPRS scores and Q angle but PNF stretching was found to be more superior.

Keywords: Patellofemoral pain syndrome, PNF Stretching, Foam rolling, Kujala pain rating scale, Q angle.

Introduction

Patellofemoral pain syndrome (PFPS) is a common knee joint problem.¹ It is also called as “anterior knee pain” or “runners knee”.² The common complaint is pain that increases with knee extension and flexion which is usually experienced at the front and around patella.

Activities such as running, climbing and descending stairs, walking, bending knees, sitting on knees or prolonged sitting can cause pain.³ The symptoms seen in Patellofemoral pain syndrome are knee pain, stiff knee, joint crepitus in flexion movement, feeling of giving away and a sensation of catching or popping.² Patellofemoral pain syndrome may be a result of a gradual compressive dysfunction or less commonly direct trauma⁴. Factors such as weak extensor muscles⁵, high body mass index⁶, mal-alignments in lower limbs⁷, increased foot pronation which increases knee valgus by internally rotating the tibia⁸, hypermobile patella, overuse or change in activities and any changes in intensity and duration of training may cause Patellofemoral pain syndrome.³ Other factors that may affect the articular cartilage or alter the forces on knee joint may include history of dislocation, trauma, and surgeries of the knee.³
This condition also compromises the strength of quadriceps, hip abductors and external rotators and affects the length of iliotibial band.\(^1\)

Nonsurgical treatment and exercise therapy has consistently been found to be effective in reducing pain in patients with PFPS in order to decrease the load on the patellofemoral joint and normalize the kinematics.\(^3\) Also according to previous studies done by Scott W. Cheatham et al\(^6\), and Victoria Gidu Diana et al\(^9\), PNF stretching technique and foam rolling has been proved to be effective in increasing muscular function, strength, flexibility and range of motion of knee joint.

Proprioceptive Neuromuscular Facilitation (PNF) was first developed by Margaret Knott PT, and Herman Kabat MD in 1940’s to treat neurological dysfunction. It increases both active and passive range of motion by improving the motor performance and rehabilitation.\(^5\)

In the past decades use of foam rollers have been used by athletes, trainers and physical therapists as a recovery and warm up tool. It is a technique in which the joint range of motion is improved and muscle pain and soreness is reduced by applying pressure to the trigger points.\(^6\)

Materials and Methodology

Participants: 40 subjects (29 male, 11 female) with Patellofemoral pain syndrome were taken. Inclusion criteria was patients of the age group 16-40 years, both male and female participants willing to participate in study, positive patellar grind test, anterior or retropatellar knee pain during at least 2 of the activities of stair climbing, hopping, running, squatting, kneeling, and prolonged sitting. Subjects with bilateral Patellofemoral pain syndrome, previous hip surgery or patellar fractures or dislocations, any neurologic involvement that would affect gait, and patients diagnosed with osteoarthritis were excluded. The study was approved by the institutional ethics committee of KIMSDU. Written informed consent was taken from the subjects those willing to participate. The subjects were randomly allocated into A) PNF stretching group (n = 20), B) Foam rolling group (n = 20).

Interventions: The subjects in Group A received PNF stretching for quadriceps and iliotibial band followed by strengthening exercises. For quadriceps stretching the subject were asked to lie prone with knees flexed, thereby moving the hip into hyperextended position and for iliotibial band stretching the subjects were asked to lie in supine position with the unaffected leg bent and crossed over the unaffected leg. For PNF stretching the affected leg was passively moved into a position where the subject felt mild discomfort and that position was held for 30 sec. The Subjects then isometrically contracted the stretched muscle for 10 seconds which was followed by muscle relaxation in the same position for 30 sec. Repeat-5 times, Rest-10 sec.

Group B was given Foam rolling exercises for quadriceps and iliotibial band followed by strengthening exercises. For quadriceps the patient were asked to lie prone keeping the foam roller perpendicular to quadriceps muscle and for iliotibial band the subjects were asked to lie on their affected side and place the roller perpendicular to the TFL and roll up and down along the muscle. Duration-1 minute, Rest -10 sec, Set -5.

Common exercises given to both the groups included,


Outcome measures

1. Visual analogue scale: (VAS -100 mm) for pain.

   The subjects were asked to mark their intensity of pain on a 10-point numerical pain rating scale ranging from 0 to 10, where 0 signifies no pain and 10 indicates worst imaginable pain and then the marked distance was measured using a scale and the values were noted.

2. Range of motion: Ask the patient to lie in supine position with the knee in extension. Place a towel roll under the ankle to allow the knee to extend as much as possible. By stabilizing the femur to prevent rotation, abduction and adduction of hip move the subject’s thigh to 90 degrees of hip flexion and move the knee into flexion

Goniometer alignment: Fulcrum- over lateral epicondyle of femur

Proximal arm- aligned with the lateral midline of femur

Distal arm- aligned with lateral midline of fibula.

3. Kujala pain rating scale: This is a 13-item knee specific questionnaire. It was documented as a response to six activities thought to be associated specifically with Patellofemoral pain syndrome. The maximum score was 100 and lower scores indicated greater pain/disability.
4. Quadriceps Angle: Subjects were asked to lie supine with their quadriceps relaxed and their knee extended. With a long axis goniometer, the quadriceps (Q) angle was measured from the anterior superior iliac spine to the middle of the base of the patella and from there to the tibial tuberosity.

Statistics

Data were analyzed using GraphPad InStat version 3.06.

RESULTS/ FINDINGS

Descriptive data of primary outcome are shown in Table no.1 & Table no.2.

VAS: The pre-interventional mean of VAS was 7.13 ± 1.48 in Group A and 6.26 ± 1.31 in Group B whereas post-interventional mean VAS was 2.99 ± 0.92 in Group A and 5.68 ± 1.35 in Group B. Intra group analysis of VAS revealed statistically reduction in VAS score post interventional for both groups. This was done by using Wilcoxon matched pairs test Group A (p < 0.0001), Group B (p < 0.0001). Inter group analysis of VAS score was done by using Mann-Whitney test. Pre intervention analysis showed no significant difference between Group A and Group B (p = 0.9676) whereas post intervention analysis showed extremely significant difference between Group A and Group B (p = 0.0005).

Knee ROM: The pre-interventional mean of ROM was 116.75 ± 4.91 in Group A and 118.45 ± 4.50 in Group B whereas post-interventional mean ROM was 124.75 ± 3.37 in Group A and 119.85 ± 5.07 in Group B. Intra group analysis of ROM revealed statistically increase in ROM score post interventional for both groups. This was done by using paired t test Group A (p < 0.0001), Group B (p = 0.0016). Inter group analysis of ROM score was done by using unpaired t test. Pre intervention analysis showed no significant difference between Group A and Group B (p = 0.0009).

Q angle: The pre-interventional mean of Q angle was 12.1 ± 1.33 in Group A and 12.15 ± 1.22 in Group B, whereas post-interventional mean of Q angle was 13 ± 1.25 in Group A and 12.4 ± 1.27 in Group B respectively. Intra group analysis of Q angle revealed statistically reduction in Q angle for Group B and increase in Group A. This was done by using paired t test Group A (p < 0.0001), Group B (p = 0.0210). Inter group analysis of Q angle was done by using unpaired t test. Pre intervention analysis showed no significant difference between Group A and Group B (p = 0.1419).

Table 1: Comparison of pre and post intervention of VAS, KPRS, Knee ROM, Q angle within the groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>VAS</th>
<th>KPRS</th>
<th>Knee ROM</th>
<th>Q angle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre treatment</td>
<td>Post treatment</td>
<td>Pre treatment</td>
<td>Post treatment</td>
</tr>
<tr>
<td>Group A</td>
<td>7.13 ± 1.48</td>
<td>2.99 ± 0.92</td>
<td>116.75 ± 4.91</td>
<td>69 ± 6.71</td>
</tr>
<tr>
<td></td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Group B</td>
<td>6.26 ± 1.31</td>
<td>5.68 ± 1.35</td>
<td>118.45 ± 4.50</td>
<td>69.75 ± 4.26</td>
</tr>
<tr>
<td></td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>
Table 2: Comparison of pre-pre and post-post intervention VAS, KPRS, knee ROM, Q angle between the groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>VAS</th>
<th>KPRS</th>
<th>Knee ROM</th>
<th>Q angle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre treatment</td>
<td>Post treatment</td>
<td>Pre treatment</td>
<td>Post treatment</td>
</tr>
<tr>
<td>Group A</td>
<td>7.31 ± 1.48</td>
<td>2.99 ± 0.92</td>
<td>69 ± 6.71</td>
<td>84.15 ± 6.91</td>
</tr>
<tr>
<td>Group B</td>
<td>6.26 ± 1.31</td>
<td>5.68 ± 1.35</td>
<td>69.75 ± 4.26</td>
<td>76.8 ± 5.77</td>
</tr>
<tr>
<td>p value</td>
<td>0.0678</td>
<td>&lt;0.0001</td>
<td>0.9676</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

**Discussion**

Usually the passive and dynamic stabilizers gives stability to Patellofemoral joint and controls “Patellar Tracking”. This passive stabilizers are the retinaculum, shape of the patella and the dynamic stabilizers are quadriceps femoris, iliobibial band, adductor magnus and longus, pes anserine, bicep femoris and vastus medialis.\(^4\)

This soft tissue structures controls the primary movements of the knee and its damage will affect integrity of the knee and allow inappropriate and exaggerated knee movements.\(^4\)

Moreover patellofemoral biomechanics can also be influenced by lower limb kinematics. “Q” angle contributes to patellar maltracking because as it increases the patella tends to move more laterally and hence increases the compressive forces on knee joint, thereby becomes a contributory factor for PFPS.\(^4\)

So the present clinical trial was conducted to find out the effect of PNF stretching and foam rolling exercises in Patellofemoral pain syndrome.

According to a study done by Pablo Alba-Martin et al\(^3\), PNF stretching and strengthening exercises for hip external rotator and abductor muscles and knee extensor muscles were most effective in relieving pain and improving function, hence the treatment selected for the present study included the above mentioned treatment. Scott W. Cheatham et al\(^6\), in his study showed that foam rollers may be an effective intervention for enhancing joint ROM and pre and post exercise muscle performance.

40 participants were screened for PFPS and randomly allocated in two groups. Group A was treated with PNF stretching and strengthening exercises and Group B was treated with Foam rolling and strengthening exercises. Strengthening exercises included closed and open kinematic chain exercises and were common for both the groups.

For statistical analysis, Mann-Whitney and Wilcoxon matched pair test were used for VAS and KPRS and paired t test was used for knee ROM and Q angle to analyze the effect of PNF stretching on Patellofemoral pain syndrome and showed that there was extremely significant improvement in VAS (p<0.0001), KPRS (p<0.0001), ROM (p<0.0001) and Q angle (p<0.0001).

PNF stretching might be effective because, the golgi tendon organ relaxes a muscle if a sustained contraction of more than 6 seconds is given. If isometric contraction and concentric contraction is used immediately before passive stretch, autogenic inhibition is facilitated. Where the golgi tendon organ is stimulated, autogenic inhibition i.e reflex relaxation takes place in the same muscle. By improving the motor performance and rehabilitation, it helps to strengthen and relax the muscle and increase both active and passive ROM.\(^5\) Also after giving exercises, it helped to strengthen the muscle and increase muscle power which helped in normalizing the biomechanics and thereby reducing pain, increasing knee range of motion, KPRS scores and normalizing Q angle.

Mann-Whitney and Wilcoxon matched pair test was used to analyze VAS and KPRS and paired t test was used to analyze knee ROM and Q angle to find the effect of foam rolling exercises on PFPS which showed that there was extremely significant improvement in VAS (p<0.0001), KPRS (p<0.0001) and very significant improvement in ROM (p= 0.0016) and significant improvement in Q angle scores (p= 0.0210).

Foam roller was effective because it helps to reduce fibrous adhesions and restrictive barriers between the layers of fascial tissue.\(^7\) This technique involves slow and small back and forth undulations over a foam roller.
This will directly place pressure on the soft tissue and creates friction between the tissues. As a result the fascia gets warmed up and become more fluid like (thixotropic property of fascia) which will break up the adhesions and restore soft tissue extensibility. This heat could contribute to reduced muscle and connective tissue viscoelasticity, thereby enhancing ROM. Increase in range of motion, flexibility and reduced muscle soreness helped in reducing pain and therefore reduced VAS and increased KPRS scores. Also the strengthening exercises helped in improving muscle imbalance and muscle strength thereby showing significant improvement in the outcome measures.

Comparison of statistical analysis between the two groups revealed that there was extremely significant difference in VAS (p <0.0001), KPRS (p= 0.0005) scores and knee ROM (p =0.0009), whereas comparison of Q angle revealed that both the groups showed same results and there was no significant difference in Q angle (p =0.1419).

Hence, above results showed that the participants treated with PNF stretching showed better pain relief, increase in knee ROM, KPRS score and Q angle in PFPS.

Conclusion

Both PNF stretching combined with strengthening exercises and Foam rolling exercises combined with strengthening exercises were effective in improving pain relief, knee ROM, KPRS scores and Q angle in PFPS but PNF stretching was found to be more superior.

Conflicts of Interest: Further studies with bilateral knee and longer duration are recommended with longer follow-up period to assess long term benefits.

Source of Funding: Krishna Institute of Medical Sciences Deemed to be University, Karad

Ethical Clearance: The study was approved by the institutional ethics committee of KIMSDU.

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Effectiveness of Swiss Ball Exercises and Mini Stability Ball Exercises on Core Strength, Endurance and Dynamic Balance in Mechanical Low Back Pain

Prachi s Jain1, Khushboo Bathia2, Smita Kanse-patil2, Amrutkuvar Rayjade2, Gatha Patel2, Vishnupriya Deshpande3

1Intern, 2Assistant Professor, 3Intern, Faculty of Physiotherapy, Krishna Institute of Medical Sciences Deemed to be University, Karad, Maharashtra, India

ABSTRACT

Objective: To compare the effects of Swiss ball exercises and mini stability ball exercises on core strength, endurance and dynamic balance in mechanical low back pain (LBP).

Method: A total of 38 subjects between age group of 18-25 years were randomly allocated into group A and B to receive swiss ball exercises and mini stability ball exercises respectively. Each subject underwent the respective treatments 5 sessions/week for 4 weeks. Outcome assessment included 60 degree curl up test, modified sorensen’s test, star excursion balance test (SEBT), modified oswestry disability questionnaire (MODQ) which was recorded at baseline, 2 and 4 weeks post treatment.

Conclusion: Both, swiss ball exercises and mini stability ball exercises were effective in reducing mechanical LBP, but mini stability ball exercises was more beneficial for improving core strength. Statistically significant difference was found within groups A and B but there was no significant difference found between group A and B.

Keywords: Swiss ball, Mini stability ball, mechanical LBP, core strength, endurance, dynamic balance.

Introduction

LBP was once known as an ancient curse and now known as a modern international epidemic(1). It is an important clinical, social, economic and public health problem that affects population at large. In India incidence of LBP has been reported to be 15% per year with a lifetime prevalence of 60-85%(1).

Mechanical LBP is defined as pain between the costal margins and the inferior gluteal folds, accompanied by painful limitation of movement, often influenced by physical activities and awkward posture, which may be associated with referred pain in lower limb(2). Mechanical LBP can occur at any age but most commonly it occurs in younger population. The criteria for mechanical LBP is pain or discomfort for less than 4 weeks, acute in onset, and discomfort relieved by rest(3).

Due to mechanical LBP the core muscles become weak which leads to reduced proprioception, balance, strength, muscle imbalance, LBP which resulting in reduced muscle endurance and flexibility. The abdominal muscles play an important role in the stabilization of spine and various motions like trunk flexion, extension, rotation and lateral flexion.

Strengthening of core muscles causes an increase in stability of the trunk to extend during reach and functional activities, these in turn, reduce the risk of back pain(4). Benefits for strengthening exercises are increase in muscle strength, size, improvement of dynamic stability, better physical capacity and appearance. Various tests are available for testing core muscle strength such as 60 degree curl up test, pressure or electromyographic biofeedback, side plank test, etc.
Improving endurance of lumbar stabilizers is the key for preventing LBP. This is done by incorporating trunk muscle endurance training which increases fatigue threshold and overall performance leading to reduced disability\(^5\). Various tests are available for assessment of endurance testing which includes side plank test, modified sorensen’s test, etc.

Dynamic activities are the activities that causes the centre of gravity to move in response to muscular activity. The benefits of dynamic balance training includes improvement in co-ordination, joint stability, reaction time etc. Dynamic balance training is an effective way to strengthen and tone the internal obliques and the muscles of the hips, thigh, gluteus and low back. It can also help to improve coordination and ability to react to sudden changes of direction. Various tests are available for dynamic balance testing which includes sit and reach test, SEBT,etc\(^6\).

There are various treatment protocols available for mechanical LBP in terms of core strength, endurance and dynamic balance training such as pilates, abdominal muscle contractions, swiss ball core exercises, planks, hanging leg raise, sling exercises, mini stability ball exercises etc. The effects of using Swiss ball are stabilization of the core of the body and hence reduction in LBP\(^4\).

To improve the muscle activity and maintain spinal stability and balance, mini stability ball can be used. It is of various sizes from 7 inches to 10 inches\(^4\). Mini stability ball provides good back support in spite of its size.

Studies have shown a beneficial effect of Swiss ball exercises on core strengthening, endurance and dynamic balance on subjects with LBP advocating the use of swiss ball exercises whereas one study showed the comparison of swiss ball and mini stability ball exercises on core strength for normal individuals and they concluded that mini stability ball exercises are more beneficial\(^4\). There is dearth of literature comparing the effects of swiss ball exercises and mini stability ball exercises on subjects with mechanical LBP and its effect on core strength, endurance and dynamic balance.

**Method**

**Study design:** The study was a randomized clinical trial.

**Participants:** 38 subjects (12 male, 26 female) of age group of 18-25 years, who had LBP and discomfort for less than 4 weeks, sudden in onset, discomfort relived on movement were taken in the study. Patients with history of low back surgery, trauma, thoracic pain, past medical history of malignant tumor, prolonged use of corticosteroids drugs, any systemic diseases, unexplained weight loss, any neurological disease, structural deformities, and LBP with radiculopathy were not included in the study. Written informed consent was taken from the subjects those willing to participate. The subjects were randomly allocated by lottery method into two groups i.e Swiss ball exercises (n = 19) and Mini stability ball exercises (n = 19). The outcome assessment was done at pre treatment, at 2 weeks and post treatment.

**Interventions**

**Table 1: Intervention protocol of group A and B**

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Protocol</th>
<th>Sets/Repetitions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GROUP A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(^{st})</td>
<td>Hot moist pack (15 minutes) + Abdominal contractions – supine – quadruped - side bridge</td>
<td>3 × 20 2 × 15 1 × 6 (each side)</td>
</tr>
<tr>
<td>2(^{nd})</td>
<td>Hot moist pack (15 minutes) + Abdominal contractions + Dead bug + Superman - supine</td>
<td>1 × 20 3 × 20 3 × 15</td>
</tr>
<tr>
<td>3(^{rd})</td>
<td>Dead bugs + Superman- supine + Swiss ball- squat + - arm crunches</td>
<td>3 × 20 3 × 15 3 × 15</td>
</tr>
<tr>
<td>4(^{th})</td>
<td>Dead bugs + Superman–supine + Swiss ball- roll out + - pike + - cross crunches + - knee up</td>
<td>3 × 20 3 × 15 3 × 15</td>
</tr>
<tr>
<td><strong>GROUP B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 1</td>
<td>Hot moist pack (15 minutes) + Abdominal contractions –supine –quadruped –side bridge</td>
<td>3 × 20 2 × 15 1 × 6 (each side)</td>
</tr>
<tr>
<td>Week 2</td>
<td>Hot moist pack + Abdominal contractions + Level 1: on mini stability ball 50,70,90 degree flexion extension</td>
<td>1 × 20 3 × 15</td>
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</tbody>
</table>
Conted…

<table>
<thead>
<tr>
<th>Level 2: on mini stability ball 50,70,90 degree flexion extension + Toes flexion extension</th>
<th>3 × 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3: on mini stability ball Right and left cross crunch + Crunch pulse exercise + Wiper exercise</td>
<td>3 × 15</td>
</tr>
</tbody>
</table>

Outcome Measures: 60degree curl up test was done with subjects positioned on the plinth against a wedge supporting the back so that the hip was flexed to 60 degrees. Knees flexed to 90 degrees as measured with goniometer in that stable arm is parallel to the ground and movable arm is at the supporting wedge. The test began when the wedge was removed and was terminated when the subject could no longer maintain the 60 degree angle independently. Subjects were asked to hold the position as much as possible. The duration on the stopwatch was noted for the individual subjects\(^{(11,13)}\).

In SEBT subjects were made to stand in a square at the centre of the grid as shown in figure with 8 lines extending from the centre at 45 degree to each other. Each of eight lines extending represent the individual directions which each subject are required to reach out in a sequence with the most distal part of their reach foot and other foot at the centre of the grid. The eight directions consists of anterolateral, anterior, anteromedial, medial, posteromedial, posterior, posterolateral and lateral. Summation of three directions i.e anterior, posterioromedial and posterolateral and limb length of that subject were taken for the statistical analysis\(^{(6)}\). Formula for calculating SEBT = \(\frac{(A+B+C)}{\text{Limb length} \times 3} \times 100\)

In MODQ, Self reported measurements of disability have been used disability as an outcome measure for people with LBP. Each topic category is followed by 6 statements describing different potential scenarios in the patient’s life relating to the topic. The patient checks the statement which most closely resembles their situation. Each question is scored on a scale of 0-5 with the first statement being zero and indicating the least amount of disability and the last statement is scored 5 indicating most severe disability. The scores for all questions answered are summed, and then multiplied by two to obtain the index (range 0 to 100). Zero is equated with no disability and 100 is the maximum disability possible\(^{(14,15)}\).

Results

<table>
<thead>
<tr>
<th>Table 2: Mean difference of all variables in Group A and B</th>
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<tbody>
<tr>
<td><strong>Weeks</strong></td>
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<tr>
<td>60 degree curl up test</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>Modified sorensens test</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>SEBT</td>
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<td>Rt</td>
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<tr>
<td>Lt</td>
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<tr>
<td>MODQ</td>
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</table>
Statistics

The outcome measures were assessed at the baseline prior to the treatment, 2 and 4 weeks after the treatment. Intra group analysis was done using Repeated Measures ANOVA. Comparison between baseline and 2 weeks, 2 and 4 weeks, baseline and 4 weeks was done by Tukey-Kramer multiple comparison test. The inter group analysis was done using unpaired t test. The analyses were performed using SPSS (version 25.0, Chicago, USA). Statistical significance was accepted for the values of p<0.05 at 95% confidence interval.

Discussion

Low back pain is one of the most common causes of disability in younger population which leads to activity limitations at work place(16). Prevalence of Low back pain is highest in the third decade of life.

We examined 38 subjects (26 females, 12 males) diagnosed with mechanical low back pain in which the majority were females. A study demonstrated a higher incidence of low back pain in females as compared to males(16). Furthermore our results differ from several studies, which demonstrated that there is no gender predilection for LBP occurrence.(2,16).

60 degree curl up test in group A, Within group comparison showed statistically significant differences within 0 - 2, 2 - 4 and 0 -4 weeks. Between groups comparison showed, there was a statistically significant difference in 60 degree curl up test which concluded that mini stability ball exercises is more effective than swiss ball exercises for core strengthening. Similarly, a study showed statistically significant difference in 60 degree curl up test after incorporating core strengthening exercises with the help of swiss ball exercise for 4 weeks was found to be significant(13).Mini stability ball gives more stability to low back within the exercises and muscle work and muscle use were greater(6). Additionally, it gives greater range of motion owing to small diameter of the mini stability ball.

This test showed statistically significant difference within0 - 2, 2 - 4 and 0 -4 weeks modified sorensens test in group A. But there was statistically not significant difference in between group A and B. According to the statistical data, swiss ball exercises and mini stability ball exercises had same effect on core endurance.A study showed that swiss ball core strength training program for 8 weeks can improve core endurance as well as it helps to improve LBP(13). Till date, no studies have shows the effect of mini stability exercises on core endurance in mechanical LBP.

By the information from the statistical data analysis, this study revealed that there was extremely significant difference within 0 -2 , 2 - 4 and 0 - 4 weeks of SEBT in group A. Inspite of that the study showed statistically

Table 3: Intra group analysis between group A and B

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F Value</td>
<td>P Value</td>
</tr>
<tr>
<td>60 Degree Curl Up Test</td>
<td>&lt;0.0001</td>
<td>142.24</td>
</tr>
<tr>
<td>Modified Sorensens Test</td>
<td>&lt;0.0001</td>
<td>174.063</td>
</tr>
<tr>
<td>Right</td>
<td>&lt;0.0001</td>
<td>172.33</td>
</tr>
<tr>
<td>Left</td>
<td>&lt;0.0001</td>
<td>133.33</td>
</tr>
</tbody>
</table>

Table 4: Inter group analysis at 0, 2 and 4 weeks

<table>
<thead>
<tr>
<th>Variables</th>
<th>0 Weeks</th>
<th>2 Weeks</th>
<th>4 Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T Value</td>
<td>P Value</td>
<td>T Value</td>
</tr>
<tr>
<td>60 Degree Curl Up Test</td>
<td>&lt;0.001</td>
<td>-1.393</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Modified Sorensens Test</td>
<td>0.268</td>
<td>2.154</td>
<td>0.198</td>
</tr>
<tr>
<td>Right</td>
<td>0.154</td>
<td>2.523</td>
<td>0.297</td>
</tr>
<tr>
<td>Left</td>
<td>0.345</td>
<td>2.483</td>
<td>0.279</td>
</tr>
<tr>
<td>Modq</td>
<td>0.673</td>
<td>1.142</td>
<td>0.189</td>
</tr>
</tbody>
</table>
not significant difference in between group A and B. Thus, the study found that swiss ball exercises and mini stability ball exercises had similar effect on dynamic balance. According to Phillip j. plisky et. al(6) dynamic balance is improved after core stabilization exercises and it shows significant difference in statistical data analysis of SEBT.

Statistically our study found that there was extremely significant difference within 0-2 , 2-4 and 0- 4 weeks of MODQ. In contrast with Between group statistical analysis found that there were not significant difference in group A and B. In conclusion we found that is swiss ball exercises and mini stability ball exercises having same effect on mechanical LBP. One showed significant difference in MODQ after giving core strengthening exercises for LBP(15). Another study shows that mini stability ball exercises reduce LBP, reduces back injury by allowing proper alignment of the spinal column(4).

**Conclusion**

Both, swiss ball and mini stability ball exercises were effective in reducing mechanical LBP, but core strength improved more in mini stability ball exercises. Statistically significant difference was found within groups A and B but there was no significant difference found between group A and B.

**Conflict of Interest:** There were no conflicts of interest in this study.

**Funding:** This study was funded by Krishna Institute of Medical sciences Deemed To Be University, Karad.

**Ethical Clearance:** The study was approved by the institutional ethics committee of KIMS DU. The trial was registered with Clinical Registry of India with no: CTRI/2018/01/011545.

**REFERENCES**


Economic Impact of FDI on Indian Automobile Sector

S. Chandrachud¹, S. Thangamayan², S. N. Sugumar³
¹Associate Professor, ²Assistant Professor, ³Professor & Head, Department of Economics, VISTAS, Chennai

ABSTRACT

Performance of manufacturing sector is a measuring scale of Economic success of any nation. Automobile Industry is one of the fastest growing Manufacturing sectors which is considered as a stepping stone for economic growth and development for the developing countries. India is sixth largest producer in the world with an average annual production of 24 million vehicles in 2016. She has the fifth largest passenger vehicle and commercial vehicle market. It contributes 7.1 percent India’s Gross Domestic Product (GDP) by volume. The current study focuses on the economic impact of FDI on Indian Automobile Sector. Chapter one provides basic idea about the Indian Automobile Sector. Chapter two enlists the review of literature. Chapter three envisages the need for the foreign investment in Indian Automobile Industry. Chapter four narrates the role of FDI in Automobile sector. Chapter five elucidates the SWOT analysis of FDI on Indian Automobile Industry. The final chapter concludes the current status of Automobile sector along with the discussion for future studies.

Keywords: Automobile, FDI, Manufacturing Industry, Commercial vehicle, passenger vehicle.

Introduction

‘Automobile’ is the term almost exclusively used for the road vehicles which includes passenger vehicles, Commercial Vehicles, three wheelers and two wheelers having the domestic market share of 14 percent, 3 percent, 3 percent and 80 percent respectively. Manufacturing of two wheelers dominates Indian Automobile Industries. The automobile industry gains its importance as it contributes 7.1 percent of Country’s Gross Domestic Product (GDP), and dominates the Indian Manufacturing Industry as it accounts for 45 percent of country’s Manufacturing Gross Domestic Product (MGDP). The Automobile industries give equal weightage for both capital intensive production and labour intensive production as it demands both technology and manpower. Currently, the automobile industry provides employment to 19 million people both directly and indirectly. The modus operandi of this study, is to analyse the economic impact of FDI on Indian Automobile industry.

Review of literature

Times of India¹ The e-bus tenders were part of a pilot scheme of the department of Heavy industries that had, in December 2017, sanctioned Rs.440 crore to 11 states for procurement of 390 electric buses, taxis and autos under Faster Adoption and Manufacturing of Hybrid and Electric Vehicle (FAME) policy that offers up to 60 percent subsidy on e-bus procurement. Goldston-BYD buses comply with all localization norms under FAME policy and Make in India. The Ashok Leyland has localization of 37 percent while TATA motors is at 35 percent.

Satyanarayana Rentala, Byram Anand, Majid Shaban² In their studies among the various determinants of export performance considered in earlier studies, this study considered export sales as the dependent variable, with sales of the firm, profitability, and R&D investments as independent variables. The results indicate that sales and R&D investments especially important in the Indian pharmaceutical industry, while profitability was found to be important in the Indian automobile industry.

Tharun Shastry L, Jyoti Pradan¹ They have concluded that a developing nation and agro based economy like India; this is a great indicator of economic development. The rapid improvement in infrastructure, huge domestic market, increasing purchasing power, established financial market and stable corporate governance framework have made the country a favourable destination for investment by global majors
in the auto industry. Access to latest and most efficient technology and techniques will bring competitive advantage to the Indian players.

Madhuri Saripalle suggested that the competitiveness in the Indian auto industry needs to be placed within the context of the restructuring taking place in the global automobile industry. This restructuring is brought about primarily by changes in demand and technology, which require different configuration of capabilities, and which result in organizational changes.

Badri Narayanan, Pankaj Vashsht the recent trends in the Indian auto industry as a whole and their implications for automotive supply chain in India. The market-oriented growth and growing automobile industry in India have ensured bright prospects for the Indian auto-component sector, which is vibrant and competitive.

Need for the FDI in Automobile sector: The Emergence of large automotive clusters in India, Delhi-Gurgaon-Faridabad in the northern part, Jamshedpur-Kolkata in eastern part, Mumbai-Pune-Nashik-Aurangabad in the western part and Chennai-Hosur-Bangalore in southern part, attract new investment for the manufacturing sector, particularly, the automobile sector. These industrial corridors are planned to invite the Foreign Direct Investment through Secretariat of Industrial approval (SIA) and Foreign Investment Promotional Board (FIPB). These investments are cent per cent automatic route. The need for the Foreign Direct Investment arises as the demand for the two wheelers are increasing in leaps and bounds and people prefers. Production of passenger vehicles, commercial vehicles, three wheelers and two wheelers grew at 14.41 per cent year-on-year between April-February 2017-18 to 26,402,671 vehicles. The auto industry is set to witness major changes in the form of electric vehicles (EVs), shared mobility, Bharat Stage-VI emission and safety norms. Electric cars in India are expected to get new green number plates and may also get free parking for three years along with toll waivers. India’s electric vehicle (EV) sales increased to 25,000 units during FY 2016-17 and are poised to rise further on the back of cheaper energy storage costs and the Government of India’s vision to see six million electric and hybrid vehicles in India by 2020. India is also encouraging a prominent auto exporter and has strong export growth expectations for the near future. Overall automobile exports grew 15.81 per cent year-on-year between April-February 2017-18. In addition, several initiatives by the Government of India and the major automobile players in the Indian market are expected to make India a leader in the 2W and Four Wheeler (4W) market in the world by 2020.

Role of FDI in Indian Automobile sector: Foreign Direct Investment policy of India, has liberalized the foreign investment through FIPB (Foreign Investment Promotional Board) under three category – Automotive, Automobile Services and Automobile Spare parts. The Government of India encourages foreign investment in the automobile sector and allows 100 percent Foreign Direct Investment (FDI) under the automatic route. Automatic approval for foreign equity investment up to 100% with no minimum investment criteria. Manufacturing and imports in this sector are exempt from licensing and approvals. The encouragement of R&D by offering rebates on R&D expenditure. The following Government initiatives enhance the role of FDI in Indian Automobile industry. The Government of Karnataka is going to obtain electric vehicles under FAME Scheme and set up charging infrastructure across Bengaluru, according to Mr R V Deshpande, Minister for Large and Medium Industries of Karnataka. The Ministry of Heavy Industries, Government of India has shortlisted 11 cities in the country for introduction of electric vehicles (EVs) in their public transport systems under the FAME (Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles in India) scheme. Energy Efficiency Services Limited (EESL), under Ministry for Power and New and Renewable Energy, Government of India, is planning to procure 10,000 e-vehicles via demand aggregation, and has already awarded contracts to Tata Motors Ltd for 250 e-cars and to Mahindra and Mahindra for 150 e-cars. The government is planning to set up a committee to develop an institutional framework on large-scale adoption of electric vehicles in India as a viable clean energy mode, especially for shared mass transport, to help bring down pollution level in major cities.

SWOT Analysis of FDI on Indian Automobile Sector: As far as the economic impact of FDI on Indian Automobile sector is concerned, fastest growing automobile market, rapid improvement in infrastructure, huge domestic market, increasing purchasing power, established financial market and stable corporate governance framework, Abundant supply of labour forces are the strength of Automobile sector. Income inequality, Political instability, Low per
capital income, Unstable government policies and their loop holes in implementation part, Non-cooperation of indigenous work force, Noncompliance of minimum wage act, Problem of statutory formalities, insufficient infrastructure, and disinterest in doing business are the weakness of FDI in Automobile Industry. The government has initiated number of policies and schemes, in order to improve the development of Automobile sector, which are considered as opportunities of FDI in Automobile Industry. The opportunities are Automotive Mission plans, Faster Adoption and Manufacturing of Hybrid and Electric vehicle (FAME), the constitution of NEMMP (National Electric Mobility Mission Plan 2020, National Automotive Testing and R&D Infrastructure Project (NATRIP), etc. along with the presence of a large pool of skilled and semi-skilled workers, strong and technical education system, presence of huge industrial corridors, availability of wide rural market for automotive requirement. However, the problems in implementation of automotive policies, problem of Economies of large scale, avoidance of Medium and small scale industry, Air Pollution, Environmental degradation, inducing lower middle class to buy the two-wheelers, etc. are the threat of FDI in Indian Automobile industry.

<table>
<thead>
<tr>
<th>Strength</th>
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<tbody>
<tr>
<td>1. fastest growing automobile market,</td>
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<tr>
<td>2. rapid improvement in infrastructure,</td>
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<td>3. huge domestic market,</td>
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<td>4. increasing purchasing power,</td>
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<td>5. established financial market and</td>
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<tr>
<td>6. stable corporate governance framework,</td>
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<td>7. Abundant supply of labour forces</td>
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<td>8. World’s 3rd largest manufacturing industry.</td>
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<td>9. SEZ/NIMZ tax holidays</td>
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<table>
<thead>
<tr>
<th>Weakness</th>
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<tbody>
<tr>
<td>1. Income inequality,</td>
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<td>2. Political instability,</td>
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<tr>
<td>3. Low per capital income,</td>
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<tr>
<td>4. Unstable government policies and their loop holes in implementation part,</td>
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<tr>
<td>5. Non-cooperation of indigenous work force,</td>
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<table>
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<tr>
<th>Opportunities</th>
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<tbody>
<tr>
<td>1. Automotive Mission plans,</td>
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<tr>
<td>2. Faster Adoption and Manufacturing of Hybrid and Electric vehicle (FAME),</td>
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<tr>
<td>3. the constitution of NEMMP (National Electric Mobility Mission Plan 2020,</td>
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<tr>
<td>4. National Automotive Testing and R&amp;D Infrastructure Project (NATRIP),</td>
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<tr>
<td>5. presence of a large pool of skilled and semi-skilled workers,</td>
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<td>6. strong and technical education system,</td>
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<td>7. presence of huge industrial corridors,</td>
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<td>8. availability of wide rural market for automotive requirement.</td>
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<tr>
<th>Economic Impact of FDI on Indian Automobile Sector</th>
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<td>1. the problems in implementation of automotive policies,</td>
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<tr>
<td>2. problem of Economies of large scale,</td>
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<td>3. avoidance of Medium and small scale industry,</td>
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<tr>
<td>4. Air Pollution,</td>
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<tr>
<td>5. Environmental degradation,</td>
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<tr>
<td>6. inducing lower middle class to buy the two-wheelers.</td>
</tr>
</tbody>
</table>

Source: Prepared by author.

**Fig. 1: SWOT Analysis–Economic Impact of FDI on Indian Automobile Sector**
Conclusion

The current research article, finds that India The auto industry is set to witness major changes in the form of electric vehicles (EVs) and in order to keep up with the growing demand, several auto makers have started investing heavily in various segments of the industry during the last few months. The industry has attracted Foreign Direct Investment (FDI) worth US$ 18.413 billion during the period April 2000 to December 2017. The industry has the capacity to create 5 million employment opportunities for the skilled and semi-skilled workers and lion share of the marketability of vehicles are in the hands of rural population.

Discussion

The current research article, paves way for future studies in the field of Environmental sustainability, Changing pattern in manufacturing structure of automobile industry (Electrical Vehicles) and opportunities of new development in automobile industry etc. The success of new schemes of the Government depends on how the policy and their implementation, particularly, Automotive mission plans of the Indian Government.

Ethical Clearance: Completed. (Dept. level committee at VELS)

Source of Funding: Self

Conflict of Interest: NIL

REFERENCES

1. Sarita C Singh, Nishtha Saluja, , “BYD plans 50% localization for eBuses in 2 years”, Times of India, April 19, 2018


Green Revolution and its Impact on Indian Agriculture

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ABSTRACT

The first agriculture research centre was established by agriculture scientist J.V.Bosingault at Ellses in 1834. Indian Green Revolution is associated with the use of HYVS (High Yielding Variety Seeds), chemical fertilizers and new techniques which led to a sharp rise in agriculture production during the middle of 1960. Expansion of area and rapid growth in productivity of wheat and rice, made possible by widespread adoption of improved varieties, expansion of agricultural research, demonstration and education, and investment in irrigation, supported by establishment of a national infrastructure to produce and supply inputs and to warehouse, distribute and market outputs. 35 per cent of India’s population below the poverty line lives in rural areas, and is directly or indirectly dependent on agriculture. The fundamental achievement of inexperienced revolution was once that there was a vast enlarges in agricultural production. Agriculture contributes more than 22 per cent of GDP (2007 estimates), although the share has progressively come down from 57 per cent in 1950-51. In developed countries like the UK and USA, the share of agriculture in GDP is only around two per cent. The new agricultural policy has made the farmers market oriented. The farmers are largely dependent on the market for the grant of inputs and for the demand for their products. At the same time, the demand for agricultural credit has also expanded as the new technology has accelerated the money requirements of the farmers.

Keywords: Agriculture, Green Revolution, Impact, Production.

Introduction

Agriculture research has made an improvement in traditional farming in every country of the world. The first agriculture research centre was established by agriculture scientist J. V. Bosingault at Ellses in 1834. It was a centre which initiated agriculture research. American Society of Agronomy was established in 1908 which accelerated agricultural development in America. Indian Society of Agronomy was established in fifties of 20th century. During 1958, for the first time in India wheat production increased from 120 lakh tones to 170 lakh tones. American Scientists developed a number of new high yielding varieties of wheat by processing wheat seeds imported from Mexico. These varieties were having production potentialities of 60-65 quintals per hectare. A similar improvement in variety of rice was also observed. As a result of introducing these high yielding varieties a true Green Revolution was observed in middle of sixties which ensured India’s self – dependence in food grains.¹ the credit for it goes not only to Nobel Laureate Dr. Norman Borlaug but also to Dr. M.S.Swaminathan. Green Revolution in India gave a rise to productivity of different crops. New techniques still possess potentialities of increasing production of wheat 2.5 times, rice 3 times, Maize 3.5 times, jowar 5 times and bajra 5.5 times. Indian Green Revolution is associated with the use of HYVS (High Yielding Variety Seeds), chemical fertilizers and new techniques which led to a sharp rise in agriculture production during the middle of 1960. During 1960-61 a programme named ‘Intensive Agriculture District Programme’ (IADP) was introduced in 7 districts of the country. This programme was aimed to provide credit loans, seeds, fertilizers, equipments etc. During 1964-65, second similar programme named ‘Intensive Agriculture Area Programme’ (IAAP) was introduced in other parts of the country. This programme was centered to a few particular specific crops. Both the programmes – IADP and IAAP were related to intensive farming but there operation was limited to traditional varieties of crops. The pioneer of Indian green revolution Mr.M.S.Swaminathan, presently chairman of National Commission on Farmers gave a new call for ‘Evergreen Revolution’ for doubling the present production level.
of foodgrains from 210 million tonnes to 420 million tonnes. For making ‘Evergreen Revolution’ a success, He stressed on adopting best scientific techniques and promoting organic farming. He also mentioned four pre requisites for getting the success.

- Promoting soil health.
- Promoting ‘Lab to Land’ exhibitions.
- Making rainwater harvesting compulsory.
- Providing credit to farmers on suitable conditions.

**Stages of Agricultural Development**

**Pre–Green Revolution:** Boost in productivity growth of coarse grains and pulses per unit of land.

**Green Revolution:** Expansion of area and rapid growth in productivity of wheat and rice, made possible by widespread adoption of improved varieties, expansion of agricultural research, demonstration and education, and investment in irrigation, supported by establishment of a national infrastructure to produce and supply inputs and to warehouse, distribute and market outputs.

**Post Green Revolution:** Continued growth in productivity through intensification of chemical and labour inputs, followed by a gradual declaration in productivity growth. Expansion of area under maize, cotton, sugarcane and oil seed.

**Commercialization:** Further diversification of cropping patterns from low value to high value crops such as fruits, vegetables, flowers and other horticulture crops for domestic consumption, processing and export. Agriculture is India’s backbone for the growth and development of the country’s economy. Nearly 65 per cent of the Indian population is still dependent on agriculture for its livelihood and employment. It is also the source of supply of raw materials for industries and provides support to the transport system. In recent years there has been great diversification in Indian agriculture such as livestock, horticulture and fisheries. Today India occupies a significant place at the global level as the second largest producer of milk. Since India’s Independence great strides have been made in the field of agriculture. Efforts made under the five year plans resulted in the growth rate of agricultural output by about 2.7 per cent per annum as compared with 0.8 per cent per annum during the first half of the 20th century. The Green Revolution of the 1960s initiated a gradual transformation of the traditional household agriculture into modern and scientific agriculture in several parts of India. The introduction of new technology in agriculture brought about unprecedented increases in yield and output of major cereal crops like rice and wheat.

**Statement of the Problem**

Agriculture forms the backbone of the Indian economy and despite concerted industrialization in the last four decades: agriculture occupies a place of price. Being the large industry in the country, agriculture is the source of livelihood for over present of population in the country. It emphasized the extension of irrigation facilities and later in the sixties adopted seed-water-fertilizer technology popularly known as the Green Revolution. Agreement on Agriculture (AoA) is opening up of world market for agricultural products. This agreement provides for abolishing non-tariff barriers and restrictions, reduction in import duty, significant reduction in subsidies, price support and other measures of protection of domestic agriculture and rationalization of export subsidies and assistance. AoA contains provisions in the broad areas of trade and agricultural policies, market access, export subsidies and domestic support.

**Objectives of the Study**

1. To analyze the growth agriculture sector in India
2. To discuss the achievements and weaknesses of Green Revolution.

**Tools of Analysis**

- Simple Regression
- Dummy Variable

**Data Analysis**

**Growth of Agricultural Output in India:** The data on the value of agricultural output expressed in 1993-94 prices over the period from 1990-91 to 2014-15 are given in Table 1. For these periods, the index number and the annual growth rates of agricultural output have been worked out and they are also give in the value of agricultural output in India was Rs.130298 crores in 1990-91, it increased with fluctuations and reached Rs.154439 crores in 1997-98 and touched the highest
The average value of agricultural output in constant prices has increased under the WTO regime however; the linear growth rate has come down to 1.78 per cent from 3.43 per cent. The growth of agricultural output (expressed in constant prices), the extent of overall globalization, and extent of globalization in the agricultural sector and the share of agricultural sector in the overall globalization have been analyzed in this section. To study the extent of overall globalization, globalization in the agricultural sector, and the contribution of agricultural sector in the globalization process, macro economic data on GNP, total exports, total imports, imports and exports of agricultural commodities have been used. To compare the present position and position before the implementation of AoA of WTO, time series data for a period 25 years from 1990-91 to 2015-16 have been used. This period is divided into two sub-periods consisting of first ten years prior to the implementation of AoA of WTO, from 1990-01 to 2000-01 and the second fifteen years period, after the implementation of AoA of WTO from 2001-02 to 2015-16. In the earlier decade, that is during 1990-91 to 1999-2000, GNP in current prices increased by 2.67 times and trade increased by 3.83 times during 2001-02 to 2015-16. In the earlier decade, that is during 1990-91 to 1999-2000, GNP in current prices increased by 3.64 times and trade increased by 5.64 times. Visibly, GNP and trade have registered a less growth in the period under WTO regime.

### Present Situation of Indian Agriculture

The following are some of the important features of Indian agriculture: Agriculture provides direct livelihood to 59 per cent of the labour force in India. 35 per cent of India’s population below the poverty line lives in rural areas, and is directly or indirectly dependent on agriculture. Agriculture contributes more than 22 per cent of GDP (2007 estimates), although the share has progressively come down from 57 per cent in 1950-51. In developed countries like the UK and USA, the share of agriculture in GDP is only around two per cent. It accounts for about 10 per cent of total value of India’s commodity exports. Bulk of agricultural exports consists of 13 key commodities including tea, coffee, tobacco, cashew, spices, raw cotton and sugar. Almost 30 per cent of tea produced in the country and 50 per cent of coffee and jute are exported. In addition to this, credit must be given for export of manufactured goods using agricultural raw materials, which accounts for another 15 per cent of India’s exports. Indian agriculture has been able to improve the per capita net availability of foodgrains to 451 grams (2007) from 395 grams in 1950’s. The gross irrigated area increased from less than one million hectares per annum before green revolution (mid 60s) to about 2.5 million hectares per annum during the 1970’s. Total gross irrigated area is now 80 million hectares. Total food grains (cereals and pulses)

---

### Table 1: Growth of Agricultural Sector in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Output Rs. Crore</th>
<th>Index Number</th>
<th>Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990-91</td>
<td>130298</td>
<td>100.00</td>
<td>--</td>
</tr>
<tr>
<td>1991-92</td>
<td>131451</td>
<td>100.88</td>
<td>0.88</td>
</tr>
<tr>
<td>1992-93</td>
<td>126668</td>
<td>97.21</td>
<td>-3.63</td>
</tr>
<tr>
<td>1993-94</td>
<td>125574</td>
<td>96.37</td>
<td>-0.86</td>
</tr>
<tr>
<td>1994-95</td>
<td>152084</td>
<td>116.72</td>
<td>21.11</td>
</tr>
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<td>1995-96</td>
<td>153218</td>
<td>117.59</td>
<td>0.74</td>
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<td>1996-97</td>
<td>158849</td>
<td>121.91</td>
<td>3.67</td>
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<td>1997-98</td>
<td>154439</td>
<td>118.52</td>
<td>-2.78</td>
</tr>
<tr>
<td>1998-99</td>
<td>151636</td>
<td>123.76</td>
<td>4.42</td>
</tr>
<tr>
<td>1999-00</td>
<td>166454</td>
<td>127.74</td>
<td>4.42</td>
</tr>
<tr>
<td>2000-01</td>
<td>175037</td>
<td>134.33</td>
<td>5.15</td>
</tr>
</tbody>
</table>

Average = 148666.18, L.G.R. 3.43%

<table>
<thead>
<tr>
<th>Year</th>
<th>Output Rs. Crore</th>
<th>Index Number</th>
<th>Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-02</td>
<td>169651</td>
<td>100.00</td>
<td>--</td>
</tr>
<tr>
<td>2002-03</td>
<td>184378</td>
<td>108.68</td>
<td>8.68</td>
</tr>
<tr>
<td>2003-04</td>
<td>176789</td>
<td>104.20</td>
<td>-4.12</td>
</tr>
<tr>
<td>2004-05</td>
<td>184378</td>
<td>108.68</td>
<td>4.29</td>
</tr>
<tr>
<td>2005-06</td>
<td>187832</td>
<td>110.71</td>
<td>1.86</td>
</tr>
<tr>
<td>2006-07</td>
<td>176285</td>
<td>103.91</td>
<td>-6.14</td>
</tr>
<tr>
<td>2007-08</td>
<td>189901</td>
<td>111.93</td>
<td>7.71</td>
</tr>
<tr>
<td>2008-09</td>
<td>162411</td>
<td>95.73</td>
<td>-14.47</td>
</tr>
<tr>
<td>2009-10</td>
<td>190312</td>
<td>112.17</td>
<td>17.17</td>
</tr>
<tr>
<td>2010-11</td>
<td>196520</td>
<td>115.83</td>
<td>3.26</td>
</tr>
<tr>
<td>2011-12</td>
<td>201234</td>
<td>117.33</td>
<td>3.76</td>
</tr>
<tr>
<td>2012-13</td>
<td>243245</td>
<td>121.33</td>
<td>4.04</td>
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<tr>
<td>2013-14</td>
<td>276899</td>
<td>125.45</td>
<td>4.44</td>
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<tr>
<td>2014-15</td>
<td>334215</td>
<td>127.34</td>
<td>4.78</td>
</tr>
<tr>
<td>2015-16</td>
<td>365780</td>
<td>131.33</td>
<td>5.21</td>
</tr>
</tbody>
</table>

Average = 181845.7, L.G.R. 1.78%

Source: Economic Survey 2016-17, GOI.
production increased from 48.1 million tonnes in 1950-51 to 230.67 million tonnes in 2008. While overall growth in food grains production has been impressive assisted by the technological breakthrough, one disturbing aspect is the year-to-year fluctuation in cereals output which affects the employment and income of the poor who depend solely on on-farm activities. This trend will also affect the food security of the masses.5

Positive Impacts of Green Revolution

The fundamental achievement of inexperienced revolution was once that there was a vast enlarges in agricultural production. Food grains output elevated from eighty one million tons in 3rd design (annual average) to 202 million tones in the tenth plan. In 2008-09, it stood at 233.9 million tones. Therefore the non meals grains were excluded from the ambit of new strategy. The manufacturing of wheat had improved from 11.1 million tones from third format (annual average) to 70.2 million tones in the 10th plan. The manufacturing of wheat had touched the high stage of 80.6 million tones in 1008-09. The overall contribution of wheat to whole meals grains has extended from 13% in1950-51 to 34.5% in 2008-09. Wheat has remained the mainstay of the Green Revolution over the year.6

The average annual production of rice additionally rose from 35.1 million tones in the third format to 85.6 million tones in the 10th plan. It stood at 99.2 million tones in 2008-09. The green revolution used to be in the main directed to expand the manufacturing of food grains. It did not have an effect on at first the manufacturing of business crops or cash crops such as sugarcane, cotton, jute, oilseeds and potatoes; this vegetation did no longer record any significant enhancement initially. However, big improvement in the output of sugarcane took location after 1973-74. Likewise, there used to be big enhancement in the manufacturing of different cash plants such as oilseeds, potatoes etc. In the 12 months 1960-61 the production of oilseeds was once solely 7 million tones which were improved to 31.1 million tones in 2009-10. The production of cotton also expanded from 6 million tones in 1960-61 to 33.4 million tones in the year 2009-10. Similarly the manufacturing of jute elevated from four million tones in1960-61 to 10.6 million tones in the yr 2009-10. The manufacturing of potatoes also accelerated from 3 million tones in 1960-61 to 36.6 million tones in 2009-10.7

Negative Impacts of Green Revolution

The new agricultural policy has made the farmers market oriented. The farmers are largely dependent on the market for the grant of inputs and for the demand for their products. At the same time, the demand for agricultural credit has also expanded as the new technology has accelerated the money requirements of the farmers.8 Besides, cutting-edge technology has certainly proved its superiority over the ordinary technology only in those areas the place fantastic prerequisites prevail. But as mentioned above the stipulations are triumphant only in selected areas. When the new agricultural approach was once delivered in the early 1960s, it was once hoped that vogue of raising output of food grains would continue. But sharp fluctuations of meals grains output were found in the later years.9

Conclusion

Agricultural sector in India does not gain much from the reform process and globalization policies. We can see that there are both positive and bad impacts of Green Revolution on Indian Economy. In the post reform period the public investment in agricultural sector has slowed down Government investment is essential to provide basic infrastructure facilities to agricultural sector.10 Due to Green Revolution agricultural region of India is capable to meet the increasing demand for food grains. Hence, the government should provide all possible support under permissible different categories of AoA to the agricultural sector, to promote the development of this sector.

Ethical Clearance: Completed

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES


An Analysis of Water Governance Arrangements of Metropolitan City in Chennai, Tamil Nadu

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ABSTRACT

The Municipal Administration and Water Supply Department is responsible for the development of urban areas in the state and for ensuring provision of infrastructure facilities to all the areas of the State. There are 12 municipal corporations, 124 Municipalities and 528 Town Panchayats under the control of Municipal Administration and Water Supply Department. The Government has accorded priority for the provision and access to safe and adequate drinking water to every house hold in the urban local bodies. The Government of India in 2013 has introduced the scheme called Jawaharlal Nehru Urban Renewal Mission (JN-NURM) to encourage reforms driven, fast track planned development of identified cities with a focus on efficiency in urban infrastructure / service delivery mechanisms, community participation and accountability of urban local bodies towards citizens. The Mission strategy includes preparing perspective plan called as City Development Plan (CDP), preparing projects, leveraging of funds and incorporating private sector efficiencies. The nodal agency for the State of Tamilnadu is TUFIDCO and the concerned department at Government of Tamilnadu is Municipal Administration and Water Supply.

Keywords: Water Supply, Metropolitan City, Government Plans.

Introduction

The Municipal Administration and Water Supply Department is responsible for the development of urban areas in the state and for ensuring provision of infrastructure facilities to all the areas of the State. The department is entrusted with the responsibility of planning, financing, implementing and monitoring projects which are aimed at attaining service level benchmark.¹ The department has made massive investment for undertaking critical capital investment works in the urban local bodies for water supply, roads, buildings, storm water drains, street lighting, solid waste management, sanitation, bus stands and commercial complexes. There are 12 municipal corporations, 124 Municipalities and 528 Town Panchayats under the control of Municipal Administration and Water Supply Department. To understand that the problems of irrigation relating to the farms activities, income level, cultivation practices, certainty and uncertainty of their economic status, drinking water scarcity, to accessing of common property beneficiaries and finally redefined their subsistence agriculture.

Water Supply

The Government has accorded priority for the provision and access to safe and adequate drinking water to every house hold in the urban local bodies. In order to improve the water supply situation the government have taken up various water supply projects availing financial assistance from various external agencies such as Japan International Cooperation Agency (JICA), German Development Bank (KFW), World Bank and under various schemes such as integrated Urban Development Mission (IUDM), JnNURM and AMRUT. These schemes are being implemented by ULBs and in some cases by the para-statal agencies like Tamil Nadu Water Supply and Drainage Board (TWAD) and the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB).⁹

Review of Literature

Several studies indicates that the improved water availability of irrigation brings a positive change in the land use pattern, cropping pattern and cropping intensity
as well as increase in the land productivity substantially. It was rightly pointed out by Dhawan (1991), the growth of crop depends on various sources of irrigation. It helps to create more employment opportunities to the rural people. It is now widely acknowledged that agricultural water management can have positive impacts for beyond the economics of crop production.

According to the Eleventh five year plan (2007-2012) quotes in India has 2.4 per cent of the world’s total area; it has 16 per cent of world population; but she has 4 per cent of the total fresh water available. That’s why it clearly indicates the need for water resource development, conservations and optimum use. Even though the country’s population had increased manifold, growth of water resources has remained stagnant for the last many years and without increase in water supply so higher Gross Domestic Product could not be achieved, it is important for us to recharge our water bodies.

Kalyan Kumar Dasgupta et.al, (1979) study found that, there has been an increase in the production of Paddy; than that of 2 and 4 times of ragi. The ratio of the cost of cultivation paddy to ragi declines as the operational holding size group increases. Therefore it depicts that the benefits of tank irrigation have been more extensive for the upper income groups.

Sakurai and Palanisami (2001) study compares the efficiency of rice production between tank and well irrigation in order to explore an appropriate management for water. This study indicates that the combined use of tank and well water is more profitable as compared to farmers who use well water only or tank water only; So neither tank or well will dominate the supply of water. Both will coexist in an evolutionary stable equilibrium

K.Sivasubramaniyan (2000), studies explains that there is a systematic relationship between cropping intensity and the location of villages in the tank. High cropping intensity was recorded in the villages under the deep sluices because of they got supplies for a longer period than the tail reach sluices villages.

Sivasubramaniyan (2006) study suggested that the well water can be recharge through the construction of watershed, tanks or else small water bodies. Wherever tank irrigation systems are available, the well water recharge is appreciable as compared to individual well, through rainfall.

Narayanamoorthy (2010) study focused on tank irrigation has been deteriorating over the years. The continuous decline of the tank irrigation can create livelihood problems for millions of farmers living in South India. Therefore the study suggested that Tamil Nadu and Karnataka states are planning to undertake the existing tanks are revival of under the assistantship of the World Bank.

**Statement of the Problem**

The sources for irrigation in Tamil Nadu are wells and tube-wells, major and medium surface reservoirs and minor surface sources. Of this, wells and tube-wells generally provide irrigation of a higher quality due to their manageable size, location advantages in relation to the area to be irrigated and improved operational and managerial efficiencies. The quality of irrigation from out major and medium surface reservoirs show perhaps the poorest results due to absence of field distribution system, water control structures and farm drainage facilities etc. The problems of canal irrigations are infestation of seeds; inception of water-borne diseases; growing income disparities, etc, these harmful environmental effects that resulted in canal irrigation at the micro level reflected the downward shift in the production of an individual decision maker and add to private costs. At the macro level, the emerging effects would be unemployment, migration, diseases, regional disparities, decline in production, ecological imbalance etc, which would escalate the public investment and add to the social costs. Farmers at the tail end of the canal system would generally receive less water as compared to those near the outlet. The tank irrigation potential is under-utilized due to the lack of tank management and poor maintenance. The difficulty of measuring irrigation quality which depends not only on the extent of groundwater use, but also on the degree to which conjunctive use off ground and surface water is in vogue, arises because of the difference in the conditions of water supply from surface sources and on the inter-relationship between sources of irrigation and rainfall.

**Objectives of the Study**

The present study would be based on the following objectives:

1. To examine the socio economic status of sample respondents in the study area.
2. To estimate the resources use efficiency in farming and drinking water of different categories of sample respondents and
3. To devise certain policy measures and strategies to avoid the existing inefficient system of irrigational sources in the study area.

Methodology

Data Collection: The required data will be collected through a survey of the respondents have been chosen from the Metropolitan city of Chennai in Tamil Nadu as well as secondary data also collect various government reports.

Table 1: Investment Plan (Rs.in Crores)

<table>
<thead>
<tr>
<th>Annual Programme</th>
<th>Investment In 2011-12</th>
<th>Investment In 2012 – 13</th>
<th>Investment In 2013 - 14</th>
<th>Investment In 2014 - 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic &amp; Transportation</td>
<td>412.16</td>
<td>237.28</td>
<td>179.48</td>
<td>199.28</td>
</tr>
<tr>
<td>Housing</td>
<td>40.77</td>
<td>65.17</td>
<td>65.27</td>
<td>68.91</td>
</tr>
<tr>
<td>Water Supply</td>
<td>581.60</td>
<td>309.03</td>
<td>99.61</td>
<td>92.67</td>
</tr>
<tr>
<td>Sewerage</td>
<td>83.16</td>
<td>122.88</td>
<td>66.23</td>
<td>49.58</td>
</tr>
<tr>
<td>Storm Water Drain</td>
<td>38.97</td>
<td>40.39</td>
<td>103.10</td>
<td>17.71</td>
</tr>
<tr>
<td>Solid Waste Management</td>
<td>-</td>
<td>3.695</td>
<td>6.06</td>
<td>9.94</td>
</tr>
<tr>
<td>Electricity</td>
<td>164.88</td>
<td>179.21</td>
<td>211.32</td>
<td>188.52</td>
</tr>
<tr>
<td>Others</td>
<td>-</td>
<td>-</td>
<td>3.36</td>
<td>0.44</td>
</tr>
<tr>
<td>Total</td>
<td>1321.54</td>
<td>957.66</td>
<td>795.58</td>
<td>670.23</td>
</tr>
</tbody>
</table>


Jawaharlal Nehru Urban Renewal Mission (JN-NURM)

The Government of India in 2013 has introduced the scheme called Jawaharlal Nehru Urban Renewal Mission (JN-NURM) to encourage reforms driven, fast tract planned development of identified cities with a focus on efficiency in urban infrastructure / service delivery mechanisms, community participation and accountability of urban local bodies towards citizens. The Mission strategy includes preparing perspective plan called as City Development Plan (CDP), preparing projects, leveraging of funds and incorporating private sector efficiencies. The nodal agency for the State of Tamilnadu is TUFIDCO and the concerned department at Government of Tamilnadu is Municipal Administration and Water Supply. Chennai is one of the identified cities for Government of India assistance under JN-NURM. To comply with the prerequisite of preparation of CDP, the City development plan for Chennai as called as ‘Development Plan for Chennai Metropolitan Area’ was prepared and Government of India’s approval obtained. The Mission strategy includes preparing perspective plan called as City Development Plan (CDP), preparing projects, leveraging of funds and incorporating private sector efficiencies. The duration of the Mission is 7 years beginning from the year 2011-12? The nodal agency for the State of Tamilnadu is TUFIDCO and the concerned department at Government of Tamilnadu is Municipal Administration and Water Supply.

Table 2: Proposed Summary of Investments in CMA (Rs.Crores)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Component</th>
<th>Total Cost</th>
<th>GoI</th>
<th>JNNURM Go TN</th>
<th>IR/IF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Water Supply</td>
<td>6,321.00</td>
<td>2,212.35</td>
<td>948.15</td>
<td>3,160.50</td>
</tr>
<tr>
<td>2.</td>
<td>Sewerage</td>
<td>2,299.00</td>
<td>804.65</td>
<td>344.85</td>
<td>1,149.50</td>
</tr>
<tr>
<td>3.</td>
<td>Solid Waste Management</td>
<td>847.80</td>
<td>296.73</td>
<td>127.17</td>
<td>423.90</td>
</tr>
<tr>
<td>4.</td>
<td>Storm Water Drainage</td>
<td>1,423.88</td>
<td>498.36</td>
<td>213.58</td>
<td>711.94</td>
</tr>
<tr>
<td>5.</td>
<td>Transportation</td>
<td>17,254.08</td>
<td>6,038.93</td>
<td>2,588.11</td>
<td>8,627.04</td>
</tr>
<tr>
<td>6.</td>
<td>Mass Rapid Transit System</td>
<td>600.00</td>
<td>210.00</td>
<td>90.00</td>
<td>300.00</td>
</tr>
</tbody>
</table>
Table 2 contd…

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>7000.00</th>
<th>2450.00</th>
<th>1050.00</th>
<th>3500.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>Metro Rail (45 km.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Parking Lots and Spaces</td>
<td>43.85</td>
<td>15.35</td>
<td>6.58</td>
<td>21.92</td>
</tr>
<tr>
<td>9.</td>
<td>Heritage and Recreation</td>
<td>103.08</td>
<td>36.08</td>
<td>15.46</td>
<td>51.54</td>
</tr>
<tr>
<td>10.</td>
<td>Satellite Town development</td>
<td>5000.00</td>
<td>1750.00</td>
<td>750.00</td>
<td>2500.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>40892.69</td>
<td>14312.45</td>
<td>6133.9</td>
<td>20446.34</td>
</tr>
<tr>
<td>11.</td>
<td>Urban Basic Services for Poor</td>
<td>3,887.23</td>
<td>1943.61</td>
<td>1943.62</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td>44779.92</td>
<td>16256.06</td>
<td></td>
<td>28523.86</td>
</tr>
</tbody>
</table>


Chennai Metropolitan Development Plan (CMDP)

Cities play a vital role in social and economic development. Efficient and productive cities are essential for national economic growth and equally, strong urban economies are essential for generating the resources needed for public and private investments in infrastructure, social facilities, improved living conditions and poverty alleviation. Environmental degradation holds back economic development. The urban challenge put forth before us is to improve the environmental quality and make the city livable. The level of services have to be improved by better planning, management and maintenance of the services, which could be achieved by channelizing the investments in the right directions.

Implications

Metropolitan city of Chennai in Tamil Nadu has mounting water crisis like irrigational and drinking purposes. Hence, there is a possibility to understand the technical efficiency among the different sources of irrigation in multiple uses and efficiency want to check up on reliable data are not sufficient. The Government of India has also constituted the (National Rainfed Area Authority) NRAA to give focused attention to the problem of rainfed areas of the country. The authority is an advisory policy making and monitoring body charged with examining guidelines in various existing schemes and in the formulation of new schemes including all externally aided projects in this area. Its mandate is wider than mere water rainfed areas, including appropriate farming and livelihood system approaches. Hence, field studies are essential to assess the technical efficiency and water use efficiency of different sources of irrigation with a case study of Chennai district in Tamil Nadu.

Conclusion

The Chennai Metropolitan Area comprises of Chennai District, a part of Thiruvallur and Kancheepuram Districts. The areas are empowered to levy water charges to individual house service Rs.1000 has to be remitted by the individual to the village panchayat to get water payment of Rs. 30 every month as water charges. The Chennai Metropolitan Development Authority for the layout of plan in the Chennai Metropolitan area, certain rural areas also situated around Chennai Corporation.

Ethical Clearance: Completed

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES


Scales under Canal, tank and Well Irrigation Systems”, Centre for Agricultural and Rural Development Studies (CARDS), Tamilnadu Agricultural University, Coimbatore, August 2006.


Performance of Tamilnadu Electricity Board

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ABSTRACT

Electricity supply in Tamil Nadu is currently the responsibility of the Tamil Nadu Electricity Board (TNEB). TNEB ranks among the top three SEBs in the country, along with Maharashtra and Gujarat, in terms of the size of its operation gauged by the generating capacity at its command, the amount of energy sold and the number of consumer services. The Electricity (supply) Act was passed in 1948 for the rationalized of the production and supply of electricity and generally for taking measures conductive electrical development. As per the Act, each state government was required to constitute a State Electricity Board and the responsibility for power supply the state was to be under its monopolistic control. Existing private or municipal licenses for power distribution were allowed to continue but no new private distributing companies or generating companies could be setup. There are five major sources of power, viz., water, coal, oil, gas and radioactive elements like uranium, thorium and plutonium. Electricity generated from water is known as hydro-electricity. Coal, oil and gas are sources of thermal power. Atomic energy is generated from uranium, thorium and plutonium. Electricity gives us comfort and happiness. It is the driving force behind the cinema and the television. These inventions along with the radio entertain the masses, the fans and the air conditioners abate the heat of the summer, the electric trains make for a journey.

Keywords: Performance, Electricity Board, Supply, Energy.

Introduction

Electricity supply in Tamil Nadu is currently the responsibility of the Tamil Nadu Electricity Board (TNEB). The TNEB is a statutory monopoly that was formed in 1957 (then known as the Madras Electricity Board) as a corporate body, in pursuance of the Electricity (supply) Act 1948. The Electricity supply Act (ESA) disallowed any new private participation in generating or distributing electricity and vested with the state electricity board (SEBs) with the sole responsibility of ensuring coordinated and efficient supply of electricity in this respective states: while the SEBs were autonomous entities, the respective state. Governments were vested with the authority, to oversee their policy decisions. TNEB ranks among the top three SEBs in the country, along with Maharashtra and Gujarat, in terms of the size of its operation gauged by the generating capacity at its command, the amount of energy sold and the number of consumer services. Tamil Nadu ranks sixth in terms of per capital electricity consumption in the states. The technical performance efficiencies of TNEB, measured by the plant load factor and the transmission and distribution losses, have normally been above the All – India average and among the top five to six SEBs. TNEB has been in the forefront of rural electrification. Extending electricity to rural areas and promoting electrification of agricultural pumps have been accorded top priority on TNEB’s agenda. As early as 1991 TNEB had reached electricity to all the inhabited villages in Tamil Nadu and the number of electrified agricultural pumps in the state has registered a phenomenal growth.¹ TNEB’s financial record is, however cause for much concern. Ever since the early seventies the average revenue realized per unit of electricity sold has been lower than the average cost of supplying a unit. If we do not take into consideration the subsidy provide by the state government. This gap has been widening over the years. The Tamil Nadu government’s directive to give free electricity to agricultural pumps and subsidized electricity to a sizeable section of the domestic consumers has been largely responsible. For this, the state government is of course committed to provide the necessary subsidies to bridge the gap. But then, as is to be expected, this is hindering capacity expansion in the sector and is also significantly eroding the health of
the state finances. TNEB is a course not along in being situated in such a predicament. Almost all the SEBs in India is going through financial crises and many of them are in worse shape compared to TNEB. In order to tackle the situation there are ongoing efforts to reforms the power sector. All this juncture it might therefore be useful to take closer look at the performance record of TNEB, analyses its strengths and weaknesses identify some major issues to be addressed and explore desirable and feasible option available for improvement.  

**Electricity Board**

The Electricity (supply) Act was passed in 1948 for the rationalized of the production and supply of electricity and generally for taking measures conductive electrical development. As per the Act, each state government was required to constitute a State Electricity Board and the responsibility for power supply the state was to be under its monopolistic control. Existing private or municipal licenses for power distribution were allowed to continue but no new private distributing companies or generating companies could be setup. Apart from the SEBs, the central or stage governments could setup, generating companies, the Madras Electricity Board was duly formed in 1957 and later it came to be known as the Tamil Nadu Electricity Board.  

**Historical Evolution of Men and Energy**

Man has needed and used energy at an increasing rate for this substance and well being ever since he came to due earth a few million years ago. Primitive Man required energy, primarily in the form of food. He derived this by eating plants or animals which he hunted, subsequently he discovered fire and his energy needs increased as he started to make use of wood and other bio-mass to supply energy needs for cooking as well as for keeping himself warm with the passage of time, man started to cultivate land, of agriculture. He added a new dimension to the use of energy by domesticate and training the animals to do work for him. With further demand for energy man began to use the wind for sailing the ships and driving windmill and the force of filling water to turn water wheels, till this time, it would not be wrong to say, that the sun was supplying all the energy of man either directly or in directly. The industrial revolution which began with the discovery of the Steam engine [AD 1700] brought about many a great change for the first time man began to use new sources of energy like coal, oil in charge qualities.  

**Sources of Energy in India**

Energy plays a crucial role in economic development. However, the consumption of energy is low in India. Its demand steadily increases with the growth of the economy. A number of researchers have observed a positive correlation between economic growth and demand for energy. It is particularly so because growth is an index of increasing productive activity which requires large quantity of energy. Consumption of energy in domestic uses and public lighting also increases with growing affluence. E.A.G. Robinson has noted that a 3 per cent rise in industrial production in the world is accompanied by a 2 per cent increase in energy consumption. A similar relationship has been observed in India. At the world level, per capita consumption of energy is much higher in high income countries as compared to India. In India, where about 35 per cent of the population is either below the poverty line or very close to it, well over half of the population does not have the purchasing power to enter the market for commercial energy. This section of population residing mostly in rural areas survives on non-commercial energy, such as firewood, during cakes and agricultural wastes. Thus the energy consumption of elites is not only 8 to 10 times that of the poorest 60 per cent of the population, but the elites are also the main consumers of commercial energy. At present about 23 per cent of the energy consumed is obtained non-commercial traditional sources. The rest is commercial energy and is obtained from oil and gas, coal, hydro-electricity and nuclear power. Production of nuclear power has begun, yet presently it is not considerable. The pattern of commercial energy consumption is characterized by a high degree of dependence on oil the share of oil and gas measured in coal replacement terms is close to 45 per cent.  

**Sources of Power (Electricity)**

There are five major sources of power, viz., water, coal, oil, gas and radioactive elements like uranium, thorium and plutonium. Electricity generated from water is known as hydro-electricity. Coal, oil and gas are sources of thermal power. Atomic energy is generated from uranium, thorium and plutonium.
Electricity and Its Uses

Now we get electricity from hydro electric project. Thermal power stations produce electricity by burning coal or oil. In advanced countries atomic energy is used to generate electricity. Electricity has become a domestic necessity. The electric lamps illuminate our houses. They light up streets and roads. By dispelling darkness they make a day of night. Electricity gives a helping hand to the house wife. Electricity gives us comfort and happiness. It is the driving force behind the cinema and the television. These inventions along with the radio entertain the masses, the fans and the air conditioners abate the heat of the summer, the electric trains make for a journey. They don’t defile the commuter with soot and smoke.7

Data Analysis

In this study an attempt is made to analyze the performance of Tamil Nadu Electricity Board.

Table 1: Electricity Capacity In Tamil Nadu The Period Of 2001-02 To 2014-15

<table>
<thead>
<tr>
<th>Period</th>
<th>Year</th>
<th>Electricity Energy</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-02</td>
<td>5,067</td>
<td>6.96</td>
<td></td>
</tr>
<tr>
<td>2002-03</td>
<td>5,723</td>
<td>12.94</td>
<td></td>
</tr>
<tr>
<td>2003-04</td>
<td>5,763</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>2004-05</td>
<td>5,988</td>
<td>3.90</td>
<td></td>
</tr>
<tr>
<td>2005-06</td>
<td>6,054</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>2006-07</td>
<td>6,521</td>
<td>7.71</td>
<td></td>
</tr>
<tr>
<td>2007-08</td>
<td>6,802</td>
<td>4.30</td>
<td></td>
</tr>
<tr>
<td>2008-09</td>
<td>7,146</td>
<td>5.05</td>
<td></td>
</tr>
<tr>
<td>2009-10</td>
<td>7,751</td>
<td>8.46</td>
<td></td>
</tr>
<tr>
<td>2010-11</td>
<td>8,315</td>
<td>7.21</td>
<td></td>
</tr>
<tr>
<td>2011-12</td>
<td>9,419</td>
<td>13.27</td>
<td></td>
</tr>
<tr>
<td>2012-13</td>
<td>10,093</td>
<td>7.15</td>
<td></td>
</tr>
<tr>
<td>2013-14</td>
<td>10,606</td>
<td>5.08</td>
<td></td>
</tr>
<tr>
<td>2014-15</td>
<td>6,828</td>
<td>-35.62</td>
<td></td>
</tr>
</tbody>
</table>

Source: Tamil Nadu Electricity Board–Statistics at a Glance and Annual Administration Reports.

Table 2: Trend Analysis of Electricity Energy of Tamil Nadu During 2001-02 to 2014-15

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Period</th>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>T</th>
<th>R²</th>
<th>CGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I</td>
<td>Linear</td>
<td>3181.26</td>
<td>384.61</td>
<td>14.94</td>
<td>0.93</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semi-log</td>
<td>8.24</td>
<td>0.05</td>
<td>25.69</td>
<td>0.97</td>
<td>5.91</td>
</tr>
</tbody>
</table>

Source: Calculated Value.

Evident that the Table-1 Data on the Electricity capacity in Tamil Nadu over the period 2001-02 to 2014-15 are given in Table 1. For the convenience of analysis the 14 years period of study into second sub periods i.e. 2001 -02 to 2014 – 15. For the second sub periods to estimate the compound growth rate of electricity energy, Linear and semi-log linear trend models have been worked out.

Table 3: The Thermal Electricity in Tamil Nadu Over the Period 2001-02 to 2014-15

<table>
<thead>
<tr>
<th>Period</th>
<th>Year</th>
<th>Thermal Electricity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-02</td>
<td>3119</td>
<td>11.83</td>
<td></td>
</tr>
<tr>
<td>2002-03</td>
<td>3775</td>
<td>2.10</td>
<td></td>
</tr>
<tr>
<td>2003-04</td>
<td>3807</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>2004-05</td>
<td>4025</td>
<td>5.72</td>
<td></td>
</tr>
<tr>
<td>2005-06</td>
<td>4058</td>
<td>0.81</td>
<td></td>
</tr>
<tr>
<td>2006-07</td>
<td>3738</td>
<td>-7.88</td>
<td></td>
</tr>
<tr>
<td>2007-08</td>
<td>4781</td>
<td>27.90</td>
<td></td>
</tr>
</tbody>
</table>

Source: Tamil Nadu Electricity Board–Statistics at a Glance and Annual Administration Reports.

In 2001-02 the thermal electricity was 3119 mw which constant by 3807 mw in 2003-04 again the thermal electricity trend witnessed increase to 4058 mw in 2005-06 and by an increase of 4781 mw in 2007-08. Finally, in 1994-95 the thermal electricity was 4658 mw in 2014-15.
Table 4: The Electricity Sales by Domestic Purposes in Tamil Nadu Over the Period 2001-02 to 2014-15

<table>
<thead>
<tr>
<th>Period</th>
<th>Year</th>
<th>Electricity Sales by Domestic</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001-02</td>
<td></td>
<td>4183.6</td>
<td>6.47</td>
</tr>
<tr>
<td>2002-03</td>
<td></td>
<td>4197.0</td>
<td>0.3</td>
</tr>
<tr>
<td>2003-04</td>
<td></td>
<td>4288.0</td>
<td>2.16</td>
</tr>
<tr>
<td>2004-05</td>
<td></td>
<td>5300.1</td>
<td>22.60</td>
</tr>
<tr>
<td>2005-06</td>
<td></td>
<td>6044.5</td>
<td>14.04</td>
</tr>
<tr>
<td>2006-07</td>
<td></td>
<td>7157.1</td>
<td>18.40</td>
</tr>
<tr>
<td>2007-08</td>
<td></td>
<td>7545.6</td>
<td>5.42</td>
</tr>
<tr>
<td>2008-09</td>
<td></td>
<td>8837.0</td>
<td>17.11</td>
</tr>
<tr>
<td>2009-10</td>
<td></td>
<td>9895.0</td>
<td>11.97</td>
</tr>
<tr>
<td>2010-11</td>
<td></td>
<td>11083.0</td>
<td>12.00</td>
</tr>
<tr>
<td>2011-12</td>
<td></td>
<td>10257.0</td>
<td>-7.45</td>
</tr>
<tr>
<td>2012-13</td>
<td></td>
<td>12307.0</td>
<td>19.98</td>
</tr>
<tr>
<td>2013-14</td>
<td></td>
<td>13006.0</td>
<td>5.67</td>
</tr>
</tbody>
</table>

Source: Tamil Nadu Electricity Board – Statistics at a Glance and Annual Administration Reports.

Table 5: Trend Analysis of Thermal Electricity of Tamil Nadu During 2001-02 To 2014-15

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Period</th>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>T</th>
<th>R²</th>
<th>CGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I</td>
<td>Linear</td>
<td>2381.69</td>
<td>153.83</td>
<td>8.91</td>
<td>0.84</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semi-log</td>
<td>7.80</td>
<td>0.044</td>
<td>8.05</td>
<td>0.81</td>
<td>4.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>II</td>
<td>Linear</td>
<td>-1446.22</td>
<td>430.56</td>
<td>14.82</td>
<td>0.89</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semi-log</td>
<td>6.62</td>
<td>0.104</td>
<td>36.23</td>
<td>0.98</td>
<td>11.03</td>
</tr>
</tbody>
</table>

Source: Calculated Value.

The results of the trend analysis imply that thermal electricity of Tamil Nadu had increased annually 153.83 during the first sub period. The regression co-efficient of the semi-log linear model implies that the thermal electricity increase at the compound growth rate of 4.57 per cent per year. The regression co-efficient in both models are significant at one per cent level.

Table 6: Trend Analysis of Electricity Sales by Domestic of Tamil Nadu During 2001-02 to 2014-15

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Period</th>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>T</th>
<th>R²</th>
<th>CGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I</td>
<td>Linear</td>
<td>1042.97</td>
<td>650.07</td>
<td>15.55</td>
<td>0.94</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semi-log</td>
<td>7.83</td>
<td>0.098</td>
<td>27.48</td>
<td>0.98</td>
<td>10.31</td>
</tr>
<tr>
<td>2.</td>
<td>II</td>
<td>Linear</td>
<td>-1446.22</td>
<td>430.56</td>
<td>14.82</td>
<td>0.89</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semi-log</td>
<td>6.62</td>
<td>0.104</td>
<td>36.23</td>
<td>0.98</td>
<td>11.03</td>
</tr>
</tbody>
</table>

Source: Calculated Value.

The results of the trend analysis imply that the electricity sales by domestic in Tamil Nadu had increased annually 650.07 mk during the second sub period. The regression coefficient of the semi-log liner model implies that the sales by domestic electricity increase at the compound growth rate of 10.31 per cent per year. The regression coefficient in both the models is significant at one per cent level.

Suggestions

1. There are 36 hydro stations in Tamil Nadu, most of the hydro stations commissioned on before 70’s. The success and performance of the industry is on the efficient functioning of these generations station are more than 30 to 40 years. Therefore, it is imperative that the existing stations should
be upgraded and renovated. This would increase the power generation and its availability. This gets further strength in the context of environmental considerations and sustained supply of the resource.

2. The cost of power purchased with the independent power producers has to be reviewed to reduce power purchase costs. The power purchase costs have to be brought down by all means as power purchased from the private sector as proportion of energy handled and sold increased substantially.

3. Transmission and distribution losses must be put under control. If the transmission and distribution losses were put under control through proper policing and monitoring, it is not necessary to purchase the power on a large scale from the independent power producers. In certain years, transmission and distribution losses and unit of power purchased are almost equal. So controlling of transmission and distribution loss may save power purchase.

4. There is a need for significant reform in the tariff structure, so far tariff has not been done in accordance with the commercial participles, still there are distortions and imperfections, for the success of tariffs they should be cost reflective and this requires a quantum hike in the tariffs. Therefore, Tamil Nadu state electricity board can make suitable changes in the tariff structure.

**Conclusion**

Tamil Nadu electricity board ranks second in installed capacity next to Maharashtra. There was an urgent need to promote generation of electricity based on such sources of energy; efforts have to been made to reduce the capital cost of projects based on non-conventional and renewable sources of energy. By improving utilization ratio also it is possible to generate additional units of power without incurring additional investments. If Tamil Nadu State Electricity Board continues renovation and modernization programmes the thermal and hydro unit can increase the next generation. Tamil Nadu Electricity Board should fix a realistic tariff that covers the cost of electricity supply and its maintenance.

**Ethical Clearance:** Completed

**Source of Funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


Performance of Mgnrega in Madurai District with Special Reference to Tamilnadu

S. Thangamayan¹, S. Chandrachud², S. N. Sugumar³
¹Assistant Professor, ²Associate Professor, ³Professor and Head, Department of Economics, VELS Institute of Science, Technology and Advanced Studies, (Deemed to be University) Chennai

ABSTRACT

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) has given rise to the largest-ever employment in human history. The share of SC/ST families in the work provided under MGNREGA is over 47 per cent and around 49 per cent of workers are women. They not only provide employment opportunities during lean agricultural seasons but also in times of floods, droughts and other natural calamities. They create rural infrastructure, which support further economic activity. Apart from providing livelihood to millions of household, these programmes have become a significant vehicle for strengthening grassroots level democratic processes. Employment generation programmes in India continue to be one of the major interventions aimed at alleviating rural poverty. Assured wage rate and employment opportunities are the important determinants of rural poverty in India. By improving the purchasing power of the rural people living below poverty line, both assured wage rate and improved employment opportunities help them to cross the poverty barriers in a sustained manner. The present study is undertaken to highlight of the MGNREGA implemented to uplift the Scheduled Castes, Scheduled Tribes and Other Backward Classes their impact for socio-economic development, in the study area of Madurai district in the state of Tamil Nadu.

Keywords: Employment Opportunities, performance, Impact.

Introduction

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) has given rise to the largest-ever employment in human history. Over the last nine years, MGNREGA has generated more than 1,827 crore person-days of work at a total expenditure of over 2,80,450 crore. Between 4.14 and 5.49 crore families got work through the programme every year in this period. The share of SC/ST families in the work provided under MGNREGA is over 47 per cent and around 49 per cent of workers are women. Average wages of workers have gone up by 118 per cent over the last nine years and since 2011, wages have been so indexed that workers are protected from the ravages of inflation. Nearly 10 crore bank/post office accounts of our poorest people have been opened and around 80 per cent of MGNREGA payments are made through this route, an unprecedented step in the direction of financial inclusion. India’s population has increased many folds every decade. Similar way of unemployment also increased in rural India. Agriculture activities are the mainstay of rural people.¹ as agriculture is gamble in the monsoon, it generates only seasonal unemployment. Climate variation, declining productivity and lack of suitable employment opportunities during most of the year after the livelihood security of the rural people, a sizable segment of them are poor. It led to be increase in multiple factor of unemployment that unemployment should eradicate through innovative employment scheme in India is required. India’s population as on 1st March 2001 stood at 1,028 million (532.1 million males on 496.4 million females). India accounts for a meager 2.4 per cent of the world surface area of 135.79 million sq.km yet it supports and sustains a whopping 16.7 per cent of the world population. The population of India, which at the turn of the twentieth century was around 238.4 million, increased to reach 1,028 million at the dawn of the twenty-first century. India, by her sustained efforts, has attained a substantial magnitude of development. However, the dark side of this development is that the rural areas could not keep pace with the urban areas for various reasons. Wage employment programmes, an important component of the anti-poverty strategy,
have sought to achieve multiple objectives. They not only provide employment opportunities during lean agricultural seasons but also in times of floods, droughts and other natural calamities. They create rural infrastructure, which support further economic activity. These programmes also put an upward pressure on market wage rates by attracting people to public works programmes, thereby reducing labour supply and pushing up demand for labour. Such an assurance would ensure a minimum level of employment and stability to the incomes of the poor and give them an opportunity to develop their collective strength. Apart from providing livelihood to millions of household, these programmes have become a significant vehicle for strengthening grassroots level democratic processes. Employment generation programmes in India continue to be one of the major interventions aimed at alleviating rural poverty. Assured wage rate and employment opportunities are the important determinants of rural poverty in India. By improving the purchasing power of the rural people living below poverty line, both assured wage rate and improved employment opportunities help them to cross the poverty barriers in a sustained manner.

Review of Literature

Reetik Khera and Nandini Nayak (2009) has analyzed about “Women workers and perceptions of the National Rural Employment Guarantee Act”. The study was based on field work in six states in 2008, and the socioeconomic consequences of the NREGA for women workers. The study reveals that, in spite of the drawbacks in the implementation of the legislation, significant benefits have already started accruing to women through better access to local employment, at minimum wages, with relatively decent and safe work conditions. The work is available at the statutory minimum wage, allowing workers to get work. Finally, this article concluded that the NREGA provided some benefits for women: migration and hazardous work now can be avoided by NREGA.

Ankitta Venkatesha Murthy et al (2010). In their study an attempted to investigate about sources of information and individuals’ insight formation about the informant in public work programmes such as National Rural Employment Guarantee Act (NREGA). Based on primary data collected from Ghodaj and Baghulgan villages in Nanded district of Maharashtra, using a qualitative research strategy-grounded theory approaches. Their study found that interpersonal relationships between the participants and implementing agents who represents the state is vital in making perceptions. Further, two information nodes – Gramsevak and Sarpanch – Turn out to be the most influential agents who act as prime informants. Their contest that there are individual cognitive limitations that hinder a person’s information seeking ability from impersonal sources, generating dependency on personal communication through core nodes mentioned.

Statement of the Problem

Socially disadvantages groups of Scheduled Castes and Scheduled Tribes have been receiving special focus over the years for their social and economic advancement. Government has taken several steps for framing appropriate policies needed to design and implement various welfare programmes for achieving the objectives of creating favourable environment to ensure specify socio-economic development of SC’S/S.T’s, and OBC’s for the well being of these communities, special target oriented programmes are being implemented by earmarking funds, providing subsidies, offering reservations in employment and educational institutions, etc. The major activities for these communities are grouped as educational development, economic development, housing and other schemes, special component plan and tribal sub-plan. Provision of burial ground and pathways to burial ground, drinking water facilities, electricity facilities etc, were also implemented. The present study is undertaken to highlight of the MGNREGA implemented to uplift the Scheduled Castes, Scheduled Tribes and Other Backward Classes their impact for socio-economic development, in the study area of Madurai district in the state of Tamil Nadu.

Objectives of the Study

1. To know the real wage increase or not after implement of MGNREGA across the states in India,
2. To know the socio economic status of pre and post reform of MGNREGA performance in the study area,
3. To examine the employment opportunities of pre and post reform of MGNREGA in the study area,
Scope of the Study

The study covers a sample of MGNREGA under Madurai district and across the different states of India. In Tamil Nadu among the district of Madurai concentrated the district has been chosen the study area.

Sampling Procedure: The multi-stage random sampling technique had been adopted for the study with the Madurai district as the universe, the block, and the village beneficiaries of MGNREGA had been considered as the different stratum.

Collection of Data: The study is based on both primary and secondary data. Secondary data was collected mainly from published sources of State Governments, Government of India. State-wise wage data for agricultural labour by gender and operation published by the Labour Bureau, Ministry of Labour and Employment, Government of India for various years have been primarily used for the analysis.

Period of the Study: The field survey was carried out during the period of May to June 2014 for the purpose of collection of the primary data. The data collection pertained to the Agriculture years of 2013 – 2014.

Tools of Analysis

The statistical tools are used to analyses the collected data and to interpret the research. In addition to tabular form, percentages, Linear Growth Rate compound growth rate, etc., were used to assess the feasibility of beneficiaries of MGNREGA under Madurai district.

Analysis of Data

Socio Economic Status of Sample Farmers in Madurai District: The present chapter provides the information of characteristics of selected sample units. It explains the socio-economic characteristics of selected sample beneficiaries of MGNREGA, such as classification of sample beneficiaries are gender, age, caste, educational status, family size in Madurai district.

Table 1: Block Wise Distribution of Sample Respondent

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Block</th>
<th>Number of Sample Respondents</th>
<th>Percentage of Sample Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Thirumangalam</td>
<td>130</td>
<td>37.7</td>
</tr>
<tr>
<td>2.</td>
<td>Usilampatti</td>
<td>90</td>
<td>26.1</td>
</tr>
<tr>
<td>3.</td>
<td>Vadipatti</td>
<td>125</td>
<td>36.2</td>
</tr>
<tr>
<td>4.</td>
<td>Total</td>
<td>345</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field Survey

Table 1 shows that Block wise Distribution sample respondent in position of four Blocks, number of sample respondent is 345. Only used by percentage analysis out 100 samples, likewise Thirumangalam Block respondents 130 (37.7) Usilampatti Block respondents per cent (26.1) 90.

Table 2: Distribution of State Wise Male Agricultural Wage

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>States</th>
<th>Growth Rate of Real Wages at 1986–87 prices.</th>
<th>Real Wage Rate of Male (Rs/day)</th>
<th>Growth Rate (percent/annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2000-01</td>
<td>2005-06</td>
</tr>
<tr>
<td>1.</td>
<td>Andhra Pradesh</td>
<td></td>
<td>15.05</td>
<td>16.03</td>
</tr>
<tr>
<td>2.</td>
<td>Bihar</td>
<td></td>
<td>16.00</td>
<td>17.00</td>
</tr>
<tr>
<td>3.</td>
<td>Gujarat</td>
<td></td>
<td>16.63</td>
<td>17.43</td>
</tr>
<tr>
<td>4.</td>
<td>Haryana</td>
<td></td>
<td>26.05</td>
<td>25.78</td>
</tr>
<tr>
<td>5.</td>
<td>Karnataka</td>
<td></td>
<td>16.98</td>
<td>16.28</td>
</tr>
<tr>
<td>6.</td>
<td>Kerala</td>
<td></td>
<td>48.10</td>
<td>47.88</td>
</tr>
<tr>
<td>7.</td>
<td>Madhya Pradesh</td>
<td></td>
<td>14.38</td>
<td>14.23</td>
</tr>
</tbody>
</table>
It is envisaged from Table 3 that the average real wage rate for male agricultural labourers has increased from Rs. 18.93/day in 2000-01 to Rs. 19.28/day in 2005-06 and then to Rs. 22.25/day in 2010-11. That is, the wage rate grew only at a rate of 0.31 per cent per annum for male labourers during pre-MGNREGA period, whereas it registered a growth rate of 2.42 per cent per annum during post-MGNREGA period at the all India level.

This trend is not only true at the national level but also turned out to be correct in most of the states considered for the analysis. For instance, of the 14 major states considered for the analysis, the wage rate registered a negative growth in 9 states during pre-MGNREGA period. Even in developed states like Punjab, Tamil Nadu and Maharashtra, the real wage rate for male agricultural labourers has declined sharply before the introduction of employment scheme.

**Table 3: Distribution of State Wise Female Agricultural Wage**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>States</th>
<th>Growth Rate of Real Wages at 1986–87 prices</th>
<th>Real Wage Rate (Rs/day)</th>
<th>Growth Rate (percent/annum)</th>
<th>Pre-MGNREGA</th>
<th>Post-MGNREGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Andhra Pradesh</td>
<td></td>
<td>10.80</td>
<td>19.80</td>
<td>0.15</td>
<td>10.46</td>
</tr>
<tr>
<td>2</td>
<td>Bihar</td>
<td></td>
<td>13.37</td>
<td>16.47</td>
<td>1.44</td>
<td>2.06</td>
</tr>
<tr>
<td>3</td>
<td>Gujarat</td>
<td></td>
<td>14.43</td>
<td>13.87</td>
<td>0.49</td>
<td>-1.15</td>
</tr>
<tr>
<td>4</td>
<td>Haryana</td>
<td></td>
<td>21.90</td>
<td>29.20</td>
<td>1.96</td>
<td>2.90</td>
</tr>
<tr>
<td>5</td>
<td>Karnataka</td>
<td></td>
<td>11.97</td>
<td>13.03</td>
<td>-0.76</td>
<td>2.21</td>
</tr>
<tr>
<td>6</td>
<td>Kerala</td>
<td></td>
<td>29.40</td>
<td>31.77</td>
<td>-0.08</td>
<td>1.38</td>
</tr>
<tr>
<td>7</td>
<td>Madhya Pradesh</td>
<td></td>
<td>11.73</td>
<td>13.33</td>
<td>-0.43</td>
<td>2.60</td>
</tr>
<tr>
<td>8</td>
<td>Maharashatra</td>
<td></td>
<td>12.20</td>
<td>13.30</td>
<td>-1.96</td>
<td>3.48</td>
</tr>
<tr>
<td>9</td>
<td>Orissa</td>
<td></td>
<td>11.80</td>
<td>18.40</td>
<td>3.61</td>
<td>3.93</td>
</tr>
<tr>
<td>10</td>
<td>Punjab</td>
<td></td>
<td>23.47</td>
<td>29.10</td>
<td>-0.97</td>
<td>4.67</td>
</tr>
<tr>
<td>11</td>
<td>Rajasthan</td>
<td></td>
<td>20.70</td>
<td>17.63</td>
<td>-4.10</td>
<td>1.53</td>
</tr>
<tr>
<td>12</td>
<td>Tamil Nadu</td>
<td></td>
<td>13.50</td>
<td>19.03</td>
<td>-0.75</td>
<td>6.70</td>
</tr>
<tr>
<td>13</td>
<td>Uttar Pradesh</td>
<td></td>
<td>15.13</td>
<td>17.43</td>
<td>-1.57</td>
<td>4.01</td>
</tr>
<tr>
<td>14</td>
<td>West Bengal</td>
<td></td>
<td>15.30</td>
<td>17.67</td>
<td>1.13</td>
<td>1.28</td>
</tr>
<tr>
<td></td>
<td>All India</td>
<td></td>
<td>14.53</td>
<td>17.47</td>
<td>0.03</td>
<td>3.11</td>
</tr>
</tbody>
</table>

It is inferred from Table 3 the wage rate has increased at a relatively faster rate for female labourers as compared to the male labourers during post-MGNREGA period. Real wage rate for female farm labourers was 14.53 day in 2000-01, but it increased to 17.47 day in 2010-11 at the all India level. In terms of growth, the wage rate grew only...
at a rate of 0.03 percent during pre-MGNREGA period, whereas it registered a growth rate of 3.11 percent per annum for female labourers during post-MGNREGA period, which is much higher than the growth rate of male wage (2.42 percent per annum). Since wages are paid for female labourers on par with the male labourers under MGNREGA scheme, it must have helped to increase the wage rate at a relatively faster pace for female labourers.

Although the growth performance of wage rate for female labourers is much better than the male counterpart, the overall state-wise scenario in terms of growth rate of wage for female labourers is almost the same with the male labourers. For instance, 8 out of 14 states have registered a negative growth rate in female wage rate during pre-MGNREGA period, which is almost the same with male wage rate as well. Similarly, except Gujarat, all others states have registered positive growth in female wage rate during MGNREGA period which is exactly matching with the growth rate of wage for male farm labourers. Not only this, our growth analysis further shows that all those states which have registered high growth rate in male wage during MGNREGA period have also recorded high growth rate in female wage rate during the same period. States like Andhra Pradesh and Tamil Nadu have registered high growth rate in male wage which is also same with female wage rate during MGNREGA period. On the whole, the analysis shows that not only the average wage rate for male and female agricultural labourers has increased considerably during the MGNREGA period across the states except Gujarat and West Bengal but the pattern of growth rate in farm wage is also the same for both male and female labourers across the states.7

**Conclusion**

To concluded that, most of the sample respondents are know about the MGNREGS through Rural work programme. The bigger percentages of sample respondents are registered by the scheme. Moreover, the rate of growth in marginal workers engaged in non-agricultural activities is found to be higher than those of main workers increasing share of marginal workers in the total workforce of non-agriculture sectors is a cause of concern.8 The Panchayats are collecting money to issue job cards in the name of the photograph and preparation of the job card. Most of the sample respondents reported awareness about the guaranteed days of employment.

**Ethical Clearance:** Completed

**Source of Funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


Economic Conditions of Govt and Private Bus Drivers in Madurai, with Special Reference to Tamilnadu

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¹Assistant Professors, ²Professor and Head, ³Associate Professor, Department of Economics, VELS Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai

ABSTRACT
Transportation is the conveyance of persons or property from one place to another. It has always been an important activity state of his development. The need for the conveyance of goods arises from the fact that they are often produced in one place and desire another. The transportation of persons arises from the need of individuals to go from one place to another to satisfy some need whether connected with business or related to social, cultural or recreational interests. The second great advancement in transportation was the road transportation, after the roads and bridges has been constructed. The development of regular systems of road making began at a period when water transport was already highly organized. The progress of transportation from the earliest times to the present consisted largely of the development and exploitation of new methods and techniques. The motor transportation has done much to put an end to the isolation of rural areas by providing means of communication and travel service. It is an outlet to millions of individual homes, and thousands of communities which were without the advantages of modern means of transportation. It affects each and every aspect of our lives, the food we eat, the clothes we wear and even our ideas about work and politics.

Keywords: Bus Drivers, Government, Private, Job Satisfaction.

Introduction
In a large counting like India, transport is especially important. The means of transport collectively constitute a large portion of our wealth. It gives employment directly or indirectly to lakhs of people and contributes substantially to national income. Labour in the transport field has been recognized as a separate factor of production. It is a human factor and therefore not only economic but moral and social consideration should also be taken into account in the discussion of problems connected with labour. Transportation is the conveyance of persons or property from one place to another. It has always been an important activity state of his development. The need for the conveyance of goods arises from the fact that they are often produced in one place and desire another. The transportation of persons arises from the need of individuals to go from one place to another to satisfy some need whether connected with business or related to social, cultural or recreational interests. The distance between the location of goods and where they are desired or between where an individual finds himself and he wants to go may be looked upon as an obstacle in time and cost. Transportation therefore focuses on the objectives of over-coming the aspects, including safety, convenience and comfort. Transportation was the first step towards civilization and a principal element in its advancement. The beginning of transport was on rivers and hence all great cities whose origins can be traced back to very early periods were situated on the banks of a river or hear the sea. The second great advancement in transportation was the road transportation, after the roads and bridges has been constructed. The development of regular systems of road making began at a period when water transport was already highly organized. The progress of transportation from the earliest times to the present consisted largely of the development and exploitation of new methods and techniques.

Importance of Transportation
Transportation is one of the major factors to ameliorate the economic as well as the commercial progress of our Indian economy. It is not possible to construct factories, mills whenever the raw materials are available. It may be due to the problem of climatic...
conditions and the problem of availability of labourers etc. so they construct the mills and factories where all the basic needs are available. Here the transportation plays a vital role by transporting the raw materials from the places where they are produced to the factories or mills where they are needed whatever the distance may be. It provides not only economic and commercial amelioration but also services as a public utility service by transporting the public from rural areas to the industrial cities to satisfy some need whether connected with business, employment or related to social, cultural or recreational interests. It is an important means of communication. Even now 40 per cent of the postal communication is done through automobile transportation. It can take policemen to the sense of crime within movements of being notified. It rushes the fire-service to the area where the houses have been gutted very soon after notification. In times of disaster, transportation can rush to aid persons, areas struck by floods, famines and earth quakes. So without transportation our society and the state could not exist.²

**Development of Transportation**

Since time immemorial means of transport have also been changing according to changed conditions, and particular requirements. In the days of human beings themselves transported their commodities, from one place to the other. This had rather become a custom that the male used to carry his weapons and the female the load of number of commodities on her head. “Perhaps it was women who on seeing a worked branch lying broken from a tree figured that a heavy load could be put on the branch and dragged with less difficulty than when carried across human shoulders. In those old days roads did not exist and people used to walk along tracks. As result of progress in trade and commerce, pack animals began to be used this traveled in caravans.³ Even in that stage of economic development roads did not exist, but wide tracks were automatically made due to the movement of hundreds of animals together. Dogs, oxen, horses, camels and similar other animals were used as the basic of bardon, and even today’s in come parts of the world their importance had not diminished.

**Transportation and Indian Economy**

The development of the gasoline engine and the emergence of the motor-transportation have had a tremendous influence on the Indian economy. It may well be contended economic forces in that regard. In order to meet the needs of our modern industrial economy, the development of highway transport has filled the missing line to the national transportation system by supplying mobility and a variety of services. Now the automobile has been significant force in moulding the pattern of social, intellectual and economic values in modern life. It is an outlet to millions of individual homes, and thousands of communities which were without the advantages of modern means of transportation. It affects each and every aspect of our lives, the food we eat, the clothes we wear and even our ideas about work and politics. Transportation has helped some nations to raise to positions of world greatness and poor transportation has caused the decline of other nations. It has of ten been the deciding factor in the winning of wars. The modern cities cannot exist without fast transportation system.⁴

Around every large city there are suburbs and railway systems which permit people to enjoy the benefits of country life at home and travel every-day to their place of business in the city. Buses, street-cars and rail-road trains are essential parts of the transportation system of any city. Modern cities are usually located at places where transportation is convenient communication between the telegraph, the telephone and the radio. However, a great many kinds of communication still depend upon transportation. The desire to travel is natural in man. From childhood onwards, he is filled with curiosity about other people, new places and things. He often satisfies this curiosity by traveling. In this way he gains knowledge of other languages customs education and religions. Travelers have also brought the culture of their own people with them in their travels in foreign countries. In this way knowledge has been speeded and communicated among various countries and people.⁵

**Statement of the Problem**

The glance at the available statistics reveals that 45 years of planned economic development in India has not had a satisfactory impact on the lives of the people and it is a visible phenomenon that the gap between rich and the poor has widened. There was no clearly defined development strategy in the past and hence the opposite income movement effect in the economy. The study on “Economic conditions of Bus drivers in Govt. and Private Companies in Madurai city” gives a special attention from the economic point of view. Economic condition is a wise term that includes and the income, expenditure, savings, indebtedness and asset positions also. The study on economic conditions of bus drivers is very important aspect. More than half of the population of country falls below the poverty line, and there are large numbers of people who cannot claim to have even a square meal a day. Such pathetic situation prevails in all walks of life especially in the private bus companies when compared to public sector or Govt. sector, are living in the same
old pathetic situation. Thus the researcher has felt that a study on the economic conditions of the Govt. and private bus companies’ drivers in the study area is very essential for their development.

**Objectives of the Study**

1. To compare the income and expenditure pattern of Govt. and private bus drivers of Madurai district.
2. To compare the problems faced by Govt. and private bus drivers of Madurai district.

**Review of Literature**

In a study on the performance of state transport undertaking (1980) conducted by the Indian Planning Commission, both physical and financial performances were analyzed by taking into account all the state transport undertakings in India. The study group pointed out that the corporations in Tamil Nadu were examples of more efficiently run organizations. In this context, the study group further suggested probing into the organizational structure and management of Tamil Nadu Transport Corporation to determine their contribution towards improved performance.

A special study (1986) conducted by the Central Institute of Road Transport revealed that the taxes levied by various governments were not uniform. This study stated that the road transport taxation had assumed critical dimensions as its incidence was dominant. The state transport undertaking under the present system required taxation relief.

The late president of United States, John F. Kennedy (1998) observed, “The basic objectives of our nations’ transport system must be to assure availability of fast, safe and economical transport services needed in a growing and changing economy to more people and goods, without waste or discriminations in response to private and public demand at the lowest cost consistent with health, convenience, national security and other broad public objectives. Investment or capacity should be neither excess nor substantially below these requirement for chronic excess capacity involves misuse of resource and lack of adequate capacity job-paradises progress.

Hanumantha Rao C.H. (1999) in his paper, “Comparative Study of Certain Traffic Parameters in selected STUs” evaluated the performance of the major STUs in India using certain selected traffic parameters such as vehicle utilization, crew utilization and occupation rate.

**Methodology**

**Area of the Study:** The researcher has selected Madurai district as the area of the study.

**Profile of the Madurai District:** Madurai is one of the historical places which are called as “Temple City”. During the sangam age it was the set of Tamil Culture. The city was planned and well laid out in the pattern of the lotus flower with the famous Sri Meenakshi Sundareswarar Temple at the centre on the occasion of namely city, it is said that Lord Siva appeared and drops a mentor from his rocks fell on the town. So it is called “Mathuram” the sweet city. From the beginning has sheltered generations of artisans and crafts man, merchants and traders, poets and schools saints and statement.

**Sources of Data:** Primary data will be collected through a well drafted questionnaire.

**Sampling Procedure:** Convenient sampling method is use to select the samples. Totally 100 samples are selected, 25 private drivers and 25 Govt. drivers were selected from buses coming to Mattuthavani bus stand, whereas 25 private drivers and 25 Govt. drivers were selected from buses coming to Arapalayam bus stand.

**Tools of Analysis**
- Simple Regression
- Dummy Variable

**Table 1: Years of Services of the Respondents**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Years of Services</th>
<th>Govt. Drivers</th>
<th>Private Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of Respondents (%)</td>
<td>No. of Respondents (%)</td>
</tr>
<tr>
<td>1.</td>
<td>Below 10 yrs</td>
<td>8 (16)</td>
<td>34 (68)</td>
</tr>
<tr>
<td>2.</td>
<td>11–20 yrs</td>
<td>25 (50)</td>
<td>10 (20)</td>
</tr>
<tr>
<td>3.</td>
<td>21–30 yrs</td>
<td>13 (26)</td>
<td>5 (10)</td>
</tr>
<tr>
<td>4.</td>
<td>31–40 yrs</td>
<td>4 (8)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>5.</td>
<td>Above 40 yrs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>50 (100)</td>
<td>50 (100)</td>
</tr>
</tbody>
</table>

**Source:** Primary Data
Table 2: Total Income Level (Monthly) of the Respondents

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Income Level (Monthly)</th>
<th>Govt. Drivers</th>
<th>Private Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of Respondents</td>
<td>(%)</td>
</tr>
<tr>
<td>1.</td>
<td>Below 10,000</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>10001 to 20,000</td>
<td>34</td>
<td>68</td>
</tr>
<tr>
<td>3.</td>
<td>200,001 to 30,000</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>4.</td>
<td>Above 30001</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary Data

Table 3: Value of Assets of the Respondents (In Lakhs)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Value of Assets</th>
<th>Govt. Drivers</th>
<th>Private Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of Respondents</td>
<td>(%)</td>
</tr>
<tr>
<td>1.</td>
<td>Below 2 lakhs</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2.</td>
<td>2 lakhs to 4 lakhs</td>
<td>29</td>
<td>58</td>
</tr>
<tr>
<td>3.</td>
<td>4 lakhs to 6 lakhs</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>4.</td>
<td>Above 6 lakhs</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary Data

Table 4: Job Satisfaction of the Respondents

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Job Satisfied with Their Income</th>
<th>Govt. Drivers</th>
<th>Private Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of Respondents</td>
<td>(%)</td>
</tr>
<tr>
<td>1.</td>
<td>Yes</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>2.</td>
<td>No</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary Data

Table 5: Level of Expenditure of the Respondents

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Expenditure Level (Thousand)</th>
<th>Govt. Drivers</th>
<th>Private Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of Respondents</td>
<td>(%)</td>
</tr>
<tr>
<td>1.</td>
<td>Below 5,000</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>5001–10000</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>3.</td>
<td>10001–15,000</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>4.</td>
<td>Above 15000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary Data

The above Tables shows that most of the private drivers and govt. drivers are 27 respondents are maximum level of expenditure. More than 7 respondents are private driver’s low level expenditure. Take into account the years of service of the respondent. Most of the private drives have put a service of less than 10
years. Most of the govt. drivers come under the category of 11 to 20 years. The most of the private drivers ear less than Rs.10,000 whereas the govt. drivers are better than the private drivers. Hence, most of their earn more than Rs.10,000. Most of the Govt. drivers own the asset from Rs.2 lakhs to Rs.4 lakhs whereas most of the private drivers hold the asset below Rs. 2 lakhs. Around three –fourth of the Govt. drivers are satisfied with the job whereas 80 per cent of the private drivers are not satisfied with the job.

Average Income of the Respondents: The study has used dummy variable to find the average income difference between Govt. drivers and private drivers.

MPC for Private Drivers: Simple regression tool was used to find the MPC of private drivers.

\[Y = 2341.03 + 0.721x + U\]

The MPC for private drivers is 0.72.

MPC for Govt. Drivers: Simple regression tool was used to find the MPC of Govt. drivers.

\[Y = 3733.04 + 0.679x + U\]

The MPC for Govt. drivers is 0.679.

\[Y = 5645.3 + 3392.03x\]

The average difference in the income earns by Govt. and a private driver is Rs.3392.03.

Findings And Conclusions

- Almost three fourth for the private drivers earn below Rs.10,000, this shows that there income is not adequate where as Govt. drivers earn higher salary.
- 18 per cent of the private drivers do not have the job satisfaction whereas 70 per cent of Govt. drivers have job satisfaction.
- There is not much difference the expenditure level of both private and Govt. drivers.

Conclusion

From the above analysis the research concludes that the economic condition of private drivers is not satisfactory whereas the condition of Govt. drivers is satisfactory.

Ethical Clearance: Completed

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES

Analysis of Problems Faced by Leaders of Rural and Urban Self Help Groups Benefitted by Micro Finance Institutions in Madurai District, Tamilnadu

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¹Assistant Professor, ²Associate Professor, ³Professor and Head, Department of Economics, VELS Institute of Science, Technology and Advanced Studies (Deemed to be University) Chennai

ABSTRACT

Micro-finance refers to the financial services to low-income clients or members of self-help groups who have poor access to banking and related services. It is the provision of thrift, credit and other financial services to the poor in rural and urban areas to enable the beneficiaries to improve their living standards. Poor repayment of internal loan by members in this problems are group members co operation related problems and raising family responsibility, Poor financial support from the family in this problem are family related problems. The success of the microcredit scheme depends on how the problems of leaders of SHGs are solved. Raising family responsibility has also been a problem for the sample leaders of rural self help groups. Family restrictions on my mobility have also been a major problem for the sample of rural self help group leaders in family related problem. The present study aims at analyzing the problems faced by leaders of rural and urban self help groups benefitted by micro finance institutions in Madurai district of Tamilnadu.

Keywords: Micro Finance, SHGs, Women Empowerment.

Introduction

Micro-finance refers to the financial services to low-income clients or members of self-help groups who have poor access to banking and related services. It is the provision of thrift, credit and other financial services to the poor in rural and urban areas to enable the beneficiaries to improve their living standards. It was started in the early 1980s in India with small efforts at forming informal self-help groups to provide access to much-needed savings and credit services. It is one of the main sources of financial assistance to the poor people. It is a powerful tool to eradicate poverty in any country. It encourages entrepreneurship and assists economically poor women to uplift their status. In fact, it aims at achieving women empowerment. It is obvious that the individual effort is not so effective to improve the economic conditions of women in India. Hence, organizing the women in a group is essential for achieving the goal of uplifting their economic conditions. In other words the idea of Self-Help Groups makes women economically independent. SHG is an informal group through which women get microcredit from the formal and semi-formal microfinance institutions. It is an unregistered group of 10 to 20 members primarily involved in savings and credit activities. It is a viable alternative to achieve the objectives of rural development and to ensure community participation in all rural development programmes. In particular, it is an organized set up to provide micro-credit to women on the strength of group savings without insisting on any collateral security for the purpose of motivating women to venture into entrepreneurial activities. NGOs and other financial institutions come forward to provide microcredit to poor women. They believe that lending to a small women group is less risky and benefits the whole family. However, Poor attendance of the members, Poor repayment of internal loan by members in this problems are group members co operation related problems and Raising family responsibility, Poor financial support from the family in this problems are family related problems. The success of the microcredit scheme depends on how the problems of leaders of SHGs are solved. The present study aims at analyzing the problems faced by leaders of rural and urban self help groups benefitted by micro finance institutions in Madurai district.
Objectives of the Study

1. To analyses the group related problems faced by the leaders of rural and urban self help groups in Madurai district.

2. To Study the personal and the family problems of the leaders that affect the rural and urban self help groups in Madurai district.

Methodology

The study utilized both primary and secondary data. The study designed two separate interview schedules for the collection of primary data. Twenty five members were contacted for pre-testing. The schedules were finalized and used for data collection. One schedule has been employed to gather general information on the SHG concerned from its office bearer. The other schedule was used to collect specific information from the selected members of SHGs. Primary data relating to the socio-economic background of SHG members, microfinance availed from Microfinance Institutions, utilization and repayment, constraints faced by the members and the various aspects about SHGs were gathered from the sample respondents by the researcher himself. The year 2010-2011 has been taken as the reference years to study the impact of Microfinance loan to SHG members.

Result Discussions

The sample leaders of rural self help groups have been asked to rank their group related problems faced by them. These problems have been studied using Garrett’s ranking technique. The results are shown in Table: 1.

Table 1: Results of Ranking Group Related Problems Faced by Leaders of Rural Shgs

<table>
<thead>
<tr>
<th>SI. No</th>
<th>Problems</th>
<th>No. of Members Reported</th>
<th>Mean Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Poor repayment of internal loan by members</td>
<td>238 (96.74)</td>
<td>79.96</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>Conflict among the members due to personal problems</td>
<td>189 (76.82)</td>
<td>40.85</td>
<td>VI</td>
</tr>
<tr>
<td>3.</td>
<td>Groupism due to political affiliation</td>
<td>109 (44.30)</td>
<td>15.32</td>
<td>X</td>
</tr>
<tr>
<td>4.</td>
<td>Groupism due to casteism</td>
<td>147 (59.75)</td>
<td>31.54</td>
<td>VII</td>
</tr>
<tr>
<td>5.</td>
<td>Delayed contribution to savings by members</td>
<td>226 (91.86)</td>
<td>67.44</td>
<td>II</td>
</tr>
<tr>
<td>6.</td>
<td>Lethargic attitude of officers of MFIs in extending group loan</td>
<td>124 (50.40)</td>
<td>18.43</td>
<td>IX</td>
</tr>
<tr>
<td>7.</td>
<td>Raising group dropout rate</td>
<td>172 (69.91)</td>
<td>45.81</td>
<td>V</td>
</tr>
<tr>
<td>8.</td>
<td>Pressure given by MFIs in the repayment of group loan</td>
<td>184 (74.79)</td>
<td>54.23</td>
<td>IV</td>
</tr>
<tr>
<td>9.</td>
<td>Poor net working of the group</td>
<td>137 (55.69)</td>
<td>24.73</td>
<td>VIII</td>
</tr>
<tr>
<td>10.</td>
<td>Poor attendance of the members</td>
<td>215 (87.39)</td>
<td>59.92</td>
<td>III</td>
</tr>
</tbody>
</table>

Source: Primary Data

Table 1 point out the Poor repayment of internal loan by members has been the most severe problem faced by leaders of rural self help groups in group related. It is to be noted here 97 per cent of sample group leaders point out that this has been most severe constraint for them. Delayed contribution to savings by members has emerged as the second severe problem faced by the rural self help group leaders in maintenance of groups. Around 92 per cent of the sample group members felt this problem in the district. Poor attendance of the members has been mentioned as the third severe constraint faced by the rural self help group leaders in group related. Pressure given by MFIs in the repayment of group loan has also been a problem for the sample leaders of rural self help groups. Raising group dropout rate has also been a major problem for the sample of rural self help group leaders in maintenance of groups. Nearly 70 per cent of the sample of the rural self help group leaders reported this problem. The inference from the analysis is that second and third problems are relating to self help group members. It may be the reason for do not come forward lead the self help group in rural area of Madurai district.

Personal and Family Problems Faced by Leaders of Rural Shgs

The sample leaders of rural self help groups have been asked to rank these problem faced by them in leading the groups. These problems were analyzed using Garrett’s ranking technique. The results are shown in Table: 2.
**Table 2: Personal and Family Problems Faced by Leaders of Rural SHGs**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Problems</th>
<th>No. of Members Reported</th>
<th>Mean Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Raising family responsibility</td>
<td>178 (72.35)</td>
<td>54.67</td>
<td>IV</td>
</tr>
<tr>
<td>2.</td>
<td>Family intervention in the repayment of MFI loan</td>
<td>231 (93.90)</td>
<td>67.38</td>
<td>II</td>
</tr>
<tr>
<td>3.</td>
<td>Health problem.</td>
<td>172 (69.91)</td>
<td>43.52</td>
<td>VI</td>
</tr>
<tr>
<td>4.</td>
<td>Poor financial support from the family.</td>
<td>240 (97.56)</td>
<td>78.91</td>
<td>I</td>
</tr>
<tr>
<td>5.</td>
<td>Poor self-confidence.</td>
<td>132 (53.65)</td>
<td>22.74</td>
<td>VIII</td>
</tr>
<tr>
<td>6.</td>
<td>Family restrictions on my mobility.</td>
<td>187 (76.01)</td>
<td>47.82</td>
<td>V</td>
</tr>
<tr>
<td>7.</td>
<td>Family intervention in the utilization of MFI loan</td>
<td>216 (87.80)</td>
<td>60.74</td>
<td>III</td>
</tr>
<tr>
<td>8.</td>
<td>Poor knowledge on the maintenance of SHG accounts</td>
<td>115 (46.74)</td>
<td>18.85</td>
<td>IX</td>
</tr>
<tr>
<td>9.</td>
<td>Poor awareness on the procedure of microfinance.</td>
<td>158 (64.22)</td>
<td>32.63</td>
<td>VII</td>
</tr>
<tr>
<td>10.</td>
<td>Family intervention in availing MFI loan.</td>
<td>104 (42.27)</td>
<td>16.21</td>
<td>X</td>
</tr>
</tbody>
</table>

**Source:** Primary Data

Table 2 points out that Poor financial support from the family has been the most severe problem faced by leaders of rural self help groups in family related problem. It is to be noted here 98 per cent of sample group leaders point out that this has been most severe constraint for them. Family intervention in the repayment of MFI loan has emerged as the second severe problem faced by the rural self help group leaders in family related problem. Raising family responsibility has also been a problem for the sample leaders of rural self help groups. Family restrictions on my mobility have also been a major problem for the sample of rural self help group leaders in family related problem. Nearly 76 per cent of the sample of the rural self help group leaders reported this problem. The inference from the analysis is that all the first three problems are relating to family interfere. It may be the reason for do not come forward lead the self help group in rural area of Madurai district.

**Table 3: Group Related Problems Faced by Leaders of Urban SHGS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Problems</th>
<th>No. of Leaders Reported</th>
<th>Mean Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Poor repayment of internal loan by members</td>
<td>102 (77.86)</td>
<td>62.35</td>
<td>III</td>
</tr>
<tr>
<td>2.</td>
<td>Conflict among the members due to personal problems</td>
<td>63 (48.09)</td>
<td>24.36</td>
<td>IX</td>
</tr>
<tr>
<td>3.</td>
<td>Groupism due to political affiliation</td>
<td>54 (41.22)</td>
<td>37.42</td>
<td>VII</td>
</tr>
<tr>
<td>4.</td>
<td>Groupism due to casteism</td>
<td>37 (28.24)</td>
<td>14.81</td>
<td>X</td>
</tr>
<tr>
<td>5.</td>
<td>Poor repayment of internal loan by members</td>
<td>112 (85.49)</td>
<td>54.24</td>
<td>IV</td>
</tr>
<tr>
<td>6.</td>
<td>Poor attendance of the members</td>
<td>127 (96.94)</td>
<td>76.02</td>
<td>I</td>
</tr>
<tr>
<td>7.</td>
<td>Poor net working of the group</td>
<td>41 (31.29)</td>
<td>32.47</td>
<td>VIII</td>
</tr>
<tr>
<td>8.</td>
<td>Delayed contribution to savings by members</td>
<td>72 (54.96)</td>
<td>43.79</td>
<td>VI</td>
</tr>
<tr>
<td>9.</td>
<td>Raising group dropout rate.</td>
<td>119 (90.83)</td>
<td>68.14</td>
<td>II</td>
</tr>
<tr>
<td>10.</td>
<td>Pressure given by MFIs in the repayment of group loan.</td>
<td>92 (70.22)</td>
<td>49.17</td>
<td>V</td>
</tr>
</tbody>
</table>

**Source:** Primary Data

Table 3 points out that Poor attendance of the members has been the most severe problem faced by leaders of urban self help groups in group related. It is to be noted here 97 per cent of sample group leaders point out that this has been most severe constraint for them. Raising group dropout rate has emerged as the second severe problem
faced by the urban self help group leaders in maintenance of groups. Around 91 per cent of the sample group members felt this problem in the district. Poor repayment of internal loan by members has been mentioned as the third severe constraint faced by the urban self help group leaders in group related. Poor repayment of internal loan by members has also been a problem for the sample leaders of urban self help groups. Pressure given by MFIs in the repayment of group loan has also been a major problem for the sample of urban self help group leaders in maintenance of groups. Nearly 70 per cent of the sample of the urban self help group leaders reported this problem.  

The inference from the analysis is that first two problems are relating to self help group members co-operation. It may be the reason for do not come forward lead the self help group in urban area of Madurai district.

Table 4: Personal and Family Problems Faced by Leaders of Urban SHGS

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Problems</th>
<th>No. of Leaders Reported</th>
<th>Mean Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Raising family responsibility</td>
<td>121 (92.36)</td>
<td>74.16</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>Family intervention in the repayment of MFI loan</td>
<td>119 (90.83)</td>
<td>52.18</td>
<td>IV</td>
</tr>
<tr>
<td>3.</td>
<td>Health problem.</td>
<td>51 (38.93)</td>
<td>24.59</td>
<td>IX</td>
</tr>
<tr>
<td>4.</td>
<td>Poor financial support from the family.</td>
<td>114 (87.02)</td>
<td>65.32</td>
<td>II</td>
</tr>
<tr>
<td>5.</td>
<td>Poor self-confidence</td>
<td>43 (32.82)</td>
<td>18.53</td>
<td>X</td>
</tr>
<tr>
<td>6.</td>
<td>Family restrictions on my mobility</td>
<td>102 (77.86)</td>
<td>59.72</td>
<td>III</td>
</tr>
<tr>
<td>7.</td>
<td>Family intervention in the utilization of MFI loan</td>
<td>94 (71.75)</td>
<td>48.71</td>
<td>V</td>
</tr>
<tr>
<td>8.</td>
<td>Poor knowledge on the maintenance of SHG accounts</td>
<td>73 (55.72)</td>
<td>42.48</td>
<td>VI</td>
</tr>
<tr>
<td>9.</td>
<td>Poor awareness on the procedure of microfinance.</td>
<td>47 (35.87)</td>
<td>31.83</td>
<td>VIII</td>
</tr>
<tr>
<td>10.</td>
<td>Family intervention in availing MFI loan</td>
<td>59 (45.03)</td>
<td>36.62</td>
<td>VII</td>
</tr>
</tbody>
</table>

Source: Primary Data.

Table 4 points out that raising family responsibility has been the most severe problem faced by leaders of urban self help groups in family related problem. It is to be noted here 92 per cent of sample group leaders point out that this has been most severe constraint for them. Poor financial support from the family has emerged as the second severe problem faced by the urban self help group leaders in family related problem. Around 87 per cent of the sample group leaders felt this problem in the district. Family restrictions on my mobility have been mentioned as the third severe constraint faced by the urban self help group leaders in family related problem. Family intervention in the repayment of MFI loan has also been a problem for the sample leaders of urban self help groups. Family interventions in the utilization of MFI loan have also been a major problem for the sample of urban self help group leaders in family related problem.  

Nearly 72 per cent of the sample of the urban self help group leaders reported this problem. The inference from the analysis is that all the first three problems are relating to family interfere. It may be the reason for do not come forward lead the self help group in urban area of Madurai district.

Policy Implications

- Establishment of regulation of microfinance
- Marketing tie up should be arranged
- New suitable insurance policy prepared by various insurance companies on Micro insurance should be introduced
- Formation of An autonomous expert Committee on SHGs and microfinance
- Special training must be provided to Bank Mangers
- Absorption of Micro entrepreneurship by MNC and other Indian companies Adoption of the SHGs/ Micro enterprises and their products by the FMCG

Conclusion

Micro finance groups arrive at certain rules and regulations to ensure that the mechanisms concerning contractual relations are in operation. Micro finance groups emerged not only to address the limitation in the rural credit markets but also the concerns relating
to poverty alleviation and women empowerment. It encourages entrepreneurship and assists economically poor women to uplift their status. Poor financial support from the family has emerged as the second severe problem faced by the urban self help group leaders in family related problem. Poor repayment of internal loan by members has been mentioned as the third severe constraint faced by the urban self help group leaders in group related.

Ethical Clearance: Completed

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES


Incidence and Association of Lactobacilli Species in Children with Early Childhood Caries

Sahana Kritivasan¹, N. P. Muralidharan², E. M. G. Subramanian³
¹Graduate Student, ²Reader, ³Professor and Head of Department of Paedodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University

ABSTRACT

Aim: To assess the incidence of Lactobacilli in children with early childhood caries.

Objective: The bacterial flora of the oral cavity will differ in infants and adults. Though viridans streptococci are the first colonizer, lactobacilli predominate in the mouth of the infants and children. The dietary habit in different age group is the major determining factor. Since the pellicle and the plaque accumulation will also have more of lactobacilli in children, it is associated with the childhood caries. So this study is done to ascertain the incidence of lactobacilli in children.

Materials and Method: Plaque samples were collected from children with early childhood caries who reported to the department of Pedodontics, Saveetha Dental College and Hospitals, Chennai, India. The samples were collected from children within 71 months of age without any prior history of antibiotic therapy for the past 15 days or oral prophylactic measures done in 3 weeks or any systemic illness using a sterile excavator and transported in cuvettes containing 1ml of saline. This was then subjected to centrifugation in which the supernatant was discarded and the sediments were used for inoculation by streak method on lactobacillus MRS Agar (Himediacode no: M6411-500G) for isolation and identification after incubating at 37°C for 24 hours.

Result: Lactobacillispwas found in 60% of the samples collected from children with Early Childhood Caries.Viridan streptococci including mutans were seen in 40% of the sample collected.

Conclusion: In the environment of low mutans count and the predominant lactobacilli population in the oral cavity of children, identifying the etiology is essential for treatment and prophylaxis of early childhood caries.

Keywords: Early childhood caries , Lactobacilli, children, microbial flora, adults

Introduction

Mouth is said to be the mirror of our body. Oral health is an important aspect of general health in infants and children that impacts the quality of life and health outcomes. The American Academy of Paediatric Dentistry defines early childhood caries as the presence of one or more decayed tooth, cavitated or non-cavitated lesion, missing due to caries, filled tooth surface in any primary tooth in a child 71 months of age or younger. [1]Dental caries is a multifactorial microbial infectious disease characterized by the demineralization of the mineralized component and destruction of organic structures of the tooth by the action of bacterial acids. [2]It is a known fact that Streptococcus mutans is the most predominant species and causative factor of
caries followed by Lactobacilli. It was considered that Streptococcus mutansis responsible for the initiation of caries and Lactobacilli helps in progression of the caries.\(^3\) The micro flora in the child may show a variation from that of adults due to their increased intake of dairy products, thereby portraying an increased incidence of lactobacilli in the normal flora.\(^4\) Early childhood caries is a multifactorial disease that’s influenced by the tooth, the mother, the child, feeding habits, dietary intake, cariogenic microorganisms that are present in the oral cavity.\(^5\) Micro biota of the others oral cavity plays an important role in the initiation of this disease as the child or infant spends most of the time with the mother or care taker and transmission of the microorganisms mainly Streptococcus mutans from the mother through spoon sharing or tasting of foods is highly prevalent.\(^6\) Due to the increased prevalence of lactobacilli which is a filamentous gram positive bacterium in children the development of caries and its progression has increased leading to its severity.\(^7\) Determining the lactobacilli incidence in association with early childhood caries in children is of utmost importance in order to have a better understanding of the disease condition and also in planning their treatment. Viridans streptococci is the first colonizer in the mouth, lactobacilli which is an opportunistic pathogen is the major bacterial flora in the mouth of the infants and children. The dietary habit in different age group is the major determining factor. Since the pellicle and the plaque accumulation will also have more of lactobacilli in children, it is associated with the childhood caries.

**Materials and Method**

**Subject Identification:** Patients who reported to the Department of Paedodontics in Saveetha Dental College and Hospitals, Chennai were screened for the prevalence of early childhood caries like one or more cavitated lesions, missing tooth due to caries, filled tooth and most importantly within the age of 71 months of age. without any prior history of antibiotic therapy for the past 15 days or oral prophylactic measures done in 3 weeks or with any systemic illness were only selected for the study.

**Sample Size:** A total of 60 patients were screened and 20 patients were identified ideal for the study and samples were collected from them.

**Sample Collection:** The supragingival dental plaque was collected from these children using a sterile excavator from the either of the surfaces such as the lingual aspect of the lower molars, buccal aspect of the upper molars and the labial aspect of the anteriors both upper and lower. The site was selected by the maximum amount of plaque that was present as the region with the highest plaque available. The collected samples were put in sterile cuvettes containing 1ml of sterile saline and immediately transported to the lab for microbiological analysis.

**Determination of the Bacteria:** The cuvettes containing the samples were agitated and a uniform suspension was obtained which was then subjected to centrifugation for 15 minutes with 2000rpm to obtain the bacterial sediment. Then the supernatant was discarded using a sterile micropipette and the sediments were used for inoculation. The sediment was transferred using sterile micropipette and inoculation on Lactobacillus MRS Agar (HiMedia code no: M6411-500G) and MacConkey agar (HiMedia code no: M008) plates by streaking method and these plates were incubated at 37\(^{0}\) C for 24 hours aerobically for the identification of lactobacilli.

**Results**

After the incubation the colonies were identified by performing the standard microbiological protocol by examination of the smear and the confirmation tests. Since Lactobacillus MRS Agar which is a selective media was used for lactobacilli, further confirmation was not needed. Among the 20 patient samples examined, 12 of them had the presence of lactobacilli growing in them which is estimated at 60%. This is found to be significant in early childhood caries cases.

**Table 1: Table showing the samples positive for lactobacilli**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sample Number</th>
<th>Lactobacilli Present or Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sample 1</td>
<td>Present</td>
</tr>
<tr>
<td>2.</td>
<td>Sample 2</td>
<td>Present</td>
</tr>
<tr>
<td>3.</td>
<td>Sample 3</td>
<td>Absent</td>
</tr>
<tr>
<td>4.</td>
<td>Sample 4</td>
<td>Absent</td>
</tr>
<tr>
<td>5.</td>
<td>Sample 5</td>
<td>Present</td>
</tr>
<tr>
<td>6.</td>
<td>Sample 6</td>
<td>Absent</td>
</tr>
<tr>
<td>7.</td>
<td>Sample 7</td>
<td>Absent</td>
</tr>
</tbody>
</table>
Attached to the oral epithelial surfaces,[10] therefore, it is unlikely that these organisms could colonize in the oral cavity of an infant before the teeth eruption takes place. The use of nursing bottles and “sippy cups” enhances the frequency of exposure to demineralisation of the enamel and dentin as the contents given in those like infant preparations, milk, fruit juices are readily metabolized by S. mutans and lactobacilli to organic acids.[11,12] This type of feeding behaviour during sleep intensifies the risk of caries, as oral clearance and salivary flow rate are decreased during sleep and proper oral hygiene practices are not followed.[13] The presence of S. mutans at 1 year of age was the most effective predictor of caries at 3.5 years of age. These observations, bring together to illustrate that early infection with S. mutans is a significant risk factor for future development of dental caries.[14,15]

There have been studies which have assessed the levels of Streptococcus mutans and lactobacilli in mothers of children with S-early childhood caries (Severe form of early childhood caries ) and caries free children. The mothers of children with S-early childhood caries had higher levels of Streptococcus mutans (38.3%) when compared to those with caries free children (11.7%). Transmission of Streptococcus mutans from the mother to child is a key event in the natural history of the disease via vertical or horizontal methods.[12]

It is stated from a study conducted by Alaluusua et al that mutacin activity facilitated transmission of species between mother and child and increased the ratio of this species in the dental biofilm, contributing to the increased risk of caries.[10] According to Yihong Lithe maternal transmission of Streptococcus mutans begins at birth and may play a significant role in early establishment of oral biota in children which compensates for the reduced level of Streptococcus mutans in a predominance.[17,18] The evidence for this concept comes from several clinical studies in which S. mutans strains isolated from mothers and their babies exhibited similar or identical bacteriocin profiles and identical plasmid or chromosomal DNA patterns. Successful colonization of infants by maternally transmitted S. mutans cells may be related to several factors, including magnitude of the inoculum, frequency of small-dose inoculations and minimum infective dose.[19] In a similar study by Berkowitz et al, when mothers’ salivary bacillary count exceeded 105 colony forming units (CFU) of MS per ml of saliva, the frequency of infant infection was 58%. When mothers harbored 103 CFU of MS per ml of

<table>
<thead>
<tr>
<th>Sample</th>
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<tbody>
<tr>
<td>Sample 8</td>
<td>Absent</td>
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<tr>
<td>Sample 9</td>
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<td>Absent</td>
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<td>Sample 11</td>
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<td>Sample 17</td>
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<td>Sample 18</td>
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<tr>
<td>Sample 19</td>
<td>Present</td>
</tr>
<tr>
<td>Sample 20</td>
<td>Present</td>
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</table>

Discussion

From the present study it is concluded that lactobacilli (60%) is more predominantly present and it out number the mutans population in all the cases examined. Its association with early childhood caries is well understood in these cases with the significant reduction and absence of Streptococcus mutans and the lactobacilli was very high.

Early childhood caries is a public health concern in the developing countries like India due to lack of knowledge about the sequel among the parents, negligence that only primary teeth that would exfoliate are affected. People neglect that early childhood caries can negatively affect the quality and self esteem of children.[8] The pathogenesis of early childhood caries is very complex thus identification of the primary causative agents is of utmost importance.

In the oral cavity of an infant generally only the mucosal surfaces are exposed to the salivary fluid flow. Streptococcus mutans could be present in such an environment by forming adherent colonies to the mucosal surfaces or by living freely in the saliva and duplicating at a rate exceeding the washout rate of the salivary flow.[9] Because the oral flora harvest only 2 to 4 average divisions per day and swallowing occurs every few minutes, it is reasonable to assume that bacteria cannot maintain themselves in saliva for a longer period of time by proliferation, but instead must attach itself to an oral surface. There are studies done which demonstrate the delicate capacity of Streptococcus mutans to become

<table>
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<td>Sample 8</td>
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attached to the oral epithelial surfaces.[10] Therefore, it is unlikely that these organisms could colonize in the oral cavity of an infant before the teeth eruption takes place. The use of nursing bottles and “sippy cups” enhances the frequency of exposure to demineralisation of the enamel and dentin as the contents given in those like infant preparations, milk, fruit juices are readily metabolized by S. mutans and lactobacilli to organic acids.[11,12] This type of feeding behaviour during sleep intensifies the risk of caries, as oral clearance and salivary flow rate are decreased during sleep and proper oral hygiene practices are not followed.[13] The presence of S. mutans at 1 year of age was the most effective predictor of caries at 3.5 years of age. These observations, bring together to illustrate that early infection with S. mutans is a significant risk factor for future development of dental caries.[14,15]

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saliva or more, the frequency of infant infection was 9 times less. The counts of S. mutans in caries risk mother and child were found to be 77% and 90% respectively in our study, whereas that of caries free mothers and child was 30% and 4% respectively. The result supports the assumption of longitudinal transmission of infection among mother and child pair.\textsuperscript{[20]} The concomitant increase in Lactobacilli count in mother and child proportionately between caries risk and caries free children. The main reason could be that during pregnancy there are increased counts of Lactobacilli in the vagina and that could be transmitted into the oral cavity.\textsuperscript{[21,10]}

A promising approach toward primary prevention of ECC is to develop strategies that target the infectious component of this disease, for example by preventing or delaying primary acquisition of S. mutans at an early age through suppression of maternal reservoirs of the organism. Another approach is to prevent S. mutans from accumulating to pathologic levels through topical application of antimicrobial agents.\textsuperscript{[22,23]}

**Conclusion**

The study threw light on the importance of knowing the microbial flora associated with early childhood caries and the predominant lactobacilli population, identifying the etiology is essential for treatment and prophylaxis. Oral prophylaxis can be as simple as consuming acidic fruits like pomegranate to advising the child to brush twice daily with proper auxilliary aids such as mouth wash, floss, etc. Maternal maintenance of a proper oral cavity is also of high importance. Educating the parents is equally important as identifying the disease and treating the child. Thereby progressing towards a healthy future by creating awareness and self maintenances.

Children consume a lot of dairy products that contain milk and sucrose, such as milk, sweets, chocolates, which are known to produce acid that facilitate lactobacilli growth in mouth. Curd the most common food of all harvest lactobacilli in plenty.\textsuperscript{[8]} Hence consuming all those products along with additives plays a major role in increasing the bacterial flora that adhere to the tooth structure leading to the susceptibility to caries. Thereby reducing the lactobacilli count in the normal flora of children by proper oral prophylactic measures and also trying to prevent the transmission from mothers can pave way for the reduction in the occurrence of the early childhood caries in children. The susceptibility to caries can be identified by performing caries susceptibility test and the susceptible children are advised to alter the food habits by reducing the intake of acidogenic food and increase the intake of more of proteinaceous food. This along with regular professional dental care will help the children from developing the early childhood caries.

**Ethical Clearance:** Taken from Saveetha Research Board

**Source of Funding:** Self

**Conflict of Interest:** Nil

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European Archives of Paediatric Dentistry. 2013 Oct 1;14(5):331-7


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Microbial Analysis of Dento Alveolar Bone Immediately after Extraction

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ABSTRACT

Aim: This study is done to analyze the microbial load present in the extracted socket immediately after the extraction.

Background: The oral cavity possesses a varied microbial flora. Extraction of tooth is done primarily due to dental caries. Identification of pathogens in the extraction socket enables us to provide a better medication to post extractions cases. In the previous studies certain bacterial species were isolated as predominant strains which are a part of the normal oral flora. But in recent studies it is found unconventional strains were demonstrated but their role in the pathogenesis is not known. This study is done to explore the other possible strains of the microbes and their frequency of isolation in the extraction site. This will be a pilot study to validate their presence.

Materials and method: After the extraction procedure was done two samples were collected one sample is collected using swab from the socket and the second sample collected using an excavator. The swab is used for aerobic culture by inoculating in blood agar at 37°C for 24hrs. The material collected using a sterile excavator is added to sterile cuvettes containing 1 ml Thioglycolate broth and incubated for 48 hrs. After 48hrs the growth were examined by sub culture onto solid media and by smear study. Grams staining was done on the smear and observed under the microscope for bacterial identification.

Result: - In this study there is an increased colonization by many bacterial species in the extraction site. The species isolated are enterococci, micrococci, CONS, lactobacilli, spirochetes, fusobacterium and gram negative cocci. In 3 patients even Candida albicans were detected. Viridans streptococcus was detected in all the samples.

Conclusion: The study has documented the multiple etiology of the tooth infection and it helps in better understanding of the pathogens present in the extraction socket and to provide a better post extraction care.

Keywords: anaerobic, aerobic, extraction socket, oral flora, microorganisms

Introduction

The mouth is a complex structure, it consist of both smooth and hard structures that are coated with saliva and numerous microbes. The oral cavity houses more than 700 microbial species. Only few among those are predominantly found in the oral cavity and some of these belong to the normal microbial flora. [1]. The normal microbial flora can be further divided into resident flora and transient flora, which is further divided into supplemental flora those that are present constantly but in lower numbers and indigenous flora these are organisms that are present constantly in high numbers[2]
The most predominant among them are the resident bacterial flora, whenever there is shift in the normal flora the transient bacterial flora proliferates to cause disease. There is constant change in the oral microbial flora as it ages, during the first few months of life before the eruption of the tooth the commonly seen organisms are Lactobacillus, Strep. salivarius and Fusobacterium, as it ages following tooth eruption the commonly seen organism are Streptococcus mutans, Streptococcus sanguis and Spirochetes. As age progresses there is a transient change in the stability of oral ecosystem which is caused due to type of food ingested, frequency of antibiotic therapy, hormonal changes of the host, any alterations in the salivary flow caused by any medications which results in decreased salivary flow predisposing to caries. In old age the host immunity reduces and this explains the increased isolation of Staphylococci and enterococci in the elderly individuals.

The oral cavity houses various bacterial species which includes both gram positive and gram negative organisms, the commonest of which being Streptococcus mutans, Streptococcus mitis, Streptococcus sanguis, Staphylococcus, Fusobacterium, Enterococcus, Peptostreptococcus, Lactobacillus, Actinomyces bifidus, Actinomycesisraeli, Actinomycesnaeslundi, Nocardia, Corynebacterium, Neisseria, and small amount of Treponemes. There exists microbial homeostasis i.e., the composition of micro flora at a specific site in the oral cavity remains constant over time despite regular minor alteration. The oral microbes face multiple changes that are not faced by any other microbes, the host has the ability to maintain good oral hygiene, also in response to eating, salivating, tooth brushing, flossing, the oral microbes have evolved the skills to survive and tolerate the changing oral environment due to these inhibitory practices. These microbes living in biofilm community increases its tolerance to antimicrobial agent and host defence mechanism and thereby enhancing the bacterial virulence. The resident microbial flora that are non-pathogenic play an important role in contributing to host physiology by preventing colonisation by potentially pathogenic microorganisms. Studies have shown there is a significant difference in the bacterial flora among healthy and diseased oral cavity. Dental plaque, a biofilm containing multiple organisms that binds onto the tooth surface should be periodically detached from the tooth surface. Failure to detach from the tooth surface leads to growth of pathogenic microorganism. This results in pathology such as dental caries and periodontal disease.

According to Shafer Dental caries is an irreversible microbial disease of the calcified tissues of the teeth characterised by degeneration of inorganic substance and destruction of organic substance of the teeth. Miller found that the bacteria produced acids that dissolved the tooth structure in the presence of fermentable carbohydrates. The three primary factors in the aetiology of dental caries are host, microbial flora and the substrate. The tooth surfaces are unique as they are the only body part that is not subject to metabolic turnover. Caries initially are painless as it progresses to the tooth pulp it manifests as pain. The initial treatment includes restoration of the tooth, if not treated at the right time it results in complete loss of tooth structure and the final option of treatment is extraction of the tooth. The most common cause for tooth extraction is known to be dental caries. The decrease in the number of teeth may affect the nutrition intake thereby affecting the quality of life. The destruction of the tooth structure to a non-restorable extent is mainly by facultative anaerobes and obligate anaerobes. Various studies have shown Streptococcus mutans as the main cause of dental decay various lactobacilli sp are associated with the progression of dental caries.

Dental extraction is defined as the painless removal of the whole tooth or tooth root, with minimal trauma to the investing tissues so that the wound heals uneventfully and no post operative problems are created. Dental extractions are indicated for various reasons such as cavities, periodontal disease, failure of endodontic treatment, retained deciduous teeth, orthodontic purpose, prosthetic and impacted teeth are to name a few. The efficient delivery of care in the surgical area not only involves accurate diagnosis, effective anesthesia, skillful surgical technique but also the sequence of normal biological events that results in the healing of the extraction site without untoward sequelae. To deliver the later through understanding of the socket and the healing sequence must be known. As the oral cavity has a lot of micro organisms as its normal flora, chances of infection within the open extracted socket is high. Microbial analysis to understand the micro flora activities in the socket is of greater importance in order to provide good healing ailments such as medications.
to prevent infection development that can cause discomfort and may lead to trauma to the tissues and surrounding dentures. Understanding this microflora is important as there is a development ofresistance to the currently available medication thus leading to more resistant strains of bacteria and also uneventful healing procedures. Most common causes of dental extraction is development of cavities. Availing oral prophylaxiscan aid to reduce incidence of cavities leading to extraction and also in preventing uneventful healing.

Oral prophylaxis can be achieved by proper habits and also consuming healthy diets. Diets play an important role in caries activity as the carbohydrates is an essential component needed for the bacteria to initiate cavities.

This aim of the study is to analyze the microbial load present in the extracted socket immediately after the extraction.

**Material and Method**

This study is done in patients referred for extraction to the oral surgery department. Sampling was done to identify the bacterial species present in the alveolar bone immediate after extraction. Utmost care was taken to avoid saliva contamination into the extraction site. The patients were give pre procedural mouth rinse with chlorhexidine minutes before the extraction. They were then advised to rinse with a clean drinking water.

Patients who reported to the outpatient department of Oral and maxillofacial surgery, Saveetha dental college were included in the study.

**Inclusion Criteria:**

(a) Patients with dental caries.
(b) Patients with restored teeth without involving the pulp
(c) Patients with periodontal problems

**Exclusion Criteria:**

(a) Patients undergoing extraction for orthodontic treatment
(b) Patients under antibiotic regime.
(c) Previous history of antibiotic consumption was also considered. Patients who were under antibiotic within month prior to the dental extraction were excluded.

(d) Impaction
(e) Root canal treated tooth

**Sample Size:** Based on the above mentioned criteria 20 Patients were selected and samples were collected.

After the extraction procedure was done two samples were collected one sample is collected using swab from the socket and the second sample collected using an excavator. The swab is used for aerobic culture by inoculating in blood agar at 37°C for 24hrs. The material collected using a sterile excavator is added to sterile cuvettes containing 1 ml Thioglycolate broth and incubated for 48 hrs. After 48hrs the growth were examined by sub culture onto solid media and by smear study. Grams staining was done on the smear and observed under the microscope for bacterial identification.

**For Aerobic Culture:** Immediately after extraction using a sterile cotton swab sample was collected from the extraction socket which was inoculated on Blood agar plates. Bacterial identification was done after incubation for 24 hours at 37°C.

**For Anaerobic Culture:** Following extraction using a sterile excavator tissue sample was collected and inoculated in cuvette containing 1 ml of Thioglycolate broth (TGB). It was incubated for 48 hours at 37 °C. After the incubation period, subculture was done on Blood agar for isolation and identification. Smear were prepared from the sediment in the TGB tube.

The colonies were identified based on smear examination, cultural characters and performing confirmative tests

**Result**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Organism Observed</th>
<th>No. of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Viridans Streptococci</td>
<td>All Samples</td>
</tr>
<tr>
<td>2.</td>
<td>Enterococcus</td>
<td>14 Samples</td>
</tr>
<tr>
<td>3.</td>
<td>CONS</td>
<td>5 Samples</td>
</tr>
<tr>
<td>4.</td>
<td>Micrococi</td>
<td>3 Samples</td>
</tr>
<tr>
<td>5.</td>
<td>Beta haemolytic Streptococci</td>
<td>1 Sample</td>
</tr>
</tbody>
</table>
Identification of the organisms associated with the alveolar bone infection were identified by both aerobic and anaerobic culture methods and confirmation was done by smear examination and confirmative tests. It is found that the viridans group of streptococci were found in all the samples collected. The next identified is enterococci which is found in 14 samples (70%), lactobacilli in 7 samples (35%), coagulase negative staphylococci in 5 samples (25%), micrococci in 3 samples, anaerobic gram negative cocci in 3 samples, beta hemolytic streptococci in 1 sample, fusiform bacteria in 2 samples and spirochaetes in 1 sample. It is significant to note the presence of Candida albicans in 3 samples collected

### Discussion

Majority of the bacterial species isolated from the samples collected are parts of the normal flora of the oral cavity. They are mostly in lesser proportion and remains undetectable in the saliva. In a susceptible individual with underlying medical cause and poor oral hygiene, the proportion of the bacteria increases and invades the healthy, ulcerated or lancerated tissue. This initially produces local lesion and ulcers in which it progresses and produces destructive lesions. One such condition is caries and loss of tooth structure.

Presence of lactobacilli indicates maintenance of poor oral hygiene as well as consumption of more of acidogenic diet. According to Marsh et al., the frequent exposure to low pH leads to inhibition of acid sensitive species and there is growth of organism with an acid uric physiology such as mutans streptococci and lactobacilli. Micrococci is a rare colonizer only when the oral flora is in imbalance its population is increased. Presence of spirochetes, fusiform bacteria and gram negative cocci are the indications of deep seated necrotic lesions probably those which indicate alveolar bone infections. According to Meenakshi et al., there was an increase in the bacterial load where they compared healthy individuals and caries susceptible individuals.

### Conclusion

Tooth extraction and destructive bone lesion are the net result of ignored attention to the vital oral health. The cariogenic activity and loss of tooth structure should not be seen as a localized issue in the mouth. It should be understood without any doubt that most of the clinical issues in the cardio vascular system, central nervous system, urogenital system and skeletal system are commonly originating from the mouth and the gastrointestinal tract. Dissemination of microbes from the mouth to the internal organs is always possible in patients with poor oral hygiene and with caries. These bacteria which originated from mouth where it is considered as commensal will be a pathogen when it is introduced into different body site. The systemic complications occurring as sequelae of deep seated oral infection may not be clinically debilitating in young age but they are the predisposition for major illnesses in adults and in old age.

**Ethical Clearance:** Taken from Saveetha Research Board

**Source of Funding:** Self

**Conflict of Interest:** Nil

### REFERENCES


Morbidity Profile of Nurses in a Tertiary Care Hospital

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St John’s Medical College, Bangalore, Karnataka, India

ABSTRACT

Background: Quality of care for hospital patients is strongly linked to the performance of nursing staff. In line with this, creating a healthy work environment for nurses is crucial to maintaining an adequate nursing workforce.

Objective: To assess the morbidity profile of nurses in a tertiary care hospital over a period of six months.

Methodology: A longitudinal descriptive study was undertaken in a private tertiary care hospital in Bangalore for a period of six months (November 2013 – April 2014). After receiving institutional ethical clearance, nursing staff were enrolled into the study (n= 287) and their health status was assessed periodically to pick up the incidence of various morbidities.

Results: Incidence rate of acute morbidity among nurses over a period of six months was 34.22 episodes per 100 person months. About 54.7% of the illnesses were infectious in nature, nearly 30.6% were musculoskeletal disorders, 1.6% had allergic reactions and 1% had needle stick injury. Among the nurses, diabetes was found to be the commonest chronic morbidity with a prevalence rate of 4.9% followed by hypertension and menstrual irregularities.

Conclusion: Infectious diseases and musculo-skeletal disorders were found to be common acute morbidities; Inclusion in Educational training programs of specific issues like sensitizing and motivating about the use of personal protective measures, awareness regarding common universal precautions and on ergonomic issues might help in reducing morbidity and mortality.

Keywords: Morbidities; Nurses;

Introduction

Nurses currently form the largest sector of health care staff. Nursing is a lifesaving profession and nurses play a pivotal role in health care service. No hospital can function effectively if there is a high incidence of ill-health among nurses.1 Quality of care for hospital patients is strongly linked to the performance of nursing staff. In line with this, creating a healthy work environment for nurses is crucial to maintaining an adequate nursing workforce.2

Nurses are a significant group of healthcare personnel in any tertiary care hospital. The nature of their work exposes them to a variety of occupational health hazards. The occupation-related health hazards that nurses are exposed to include biological, physical, chemical, psychological and ergonomic hazards and mainly are related to the pressures of job and non-standard work facilities.3Therefore a special focus is required to identify their morbidities and their health concerns.

Studies that address the overall morbidity patterns in nurses are limited. Extensive review of literature revealed that there no studies published in India which looks at a comprehensive morbidity profile of nurses. This study therefore plans to identify the morbidity profile and risk factors associated with morbidity in nurses so that effective health and safety measures may be developed and implemented.

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Method

This was a descriptive longitudinal study conducted between November 2013 and April 2014 in a private tertiary care teaching hospital in Bangalore Urban District, Karnataka. All nursing staff who have completed at least one year of service in the Medical College Hospital were included in the study. Sample size of 368 was calculated with prevalence (assumed prevalence) of any morbidity (based on previous studies) taken as 40%. Further, the calculated sample size was corrected for a finite population which comes to around 241. Presuming an attrition rate of 10%, the number of nurses that this study was expected to include was 265. However in this study we were able to follow-up 287 nursing staffs.

Nurses were divided into various strata such as those from medicine and allied departments, surgery and allied departments and nurses from OT (operation theatre) and then number of nurses from each strata was decided according to the probability proportional to the size.

Nurses from each stratum were then selected by simple random sampling. Institutional Ethical Clearance was obtained for the study. A written informed consent was sought from the employees which included permission to review the sick leave register and their medical records.

Chronic illness was elicited by a thorough review of past history and review of the nurses’ hospital record. The health status and acute illness of the nurses was assessed once in three months (for six months only) by the following two methods:

1. Interview with nurses to identify any significant illness in the past three months
2. Review of applications for sick leave maintained in the personnel department.

The data was entered and coded in Microsoft excel and analyzed using SPSS version20.

Results

A total of 287 nursing staffs were included in this study. Of all, 130(45.3%) worked in Medicine and allied Departments, 123(42.9%) were from Surgery and allied departments and 34(11.8%) were working in the Operation Theatre. Of the 287 nursing staff, majority 187(65.2%) were in the age group of 21-30 years and were females. Majority 165(57.5%) belong to class I socio economic status and were residents of hostel. Of the total staffs most of them were single 226 (78.7%), Christians and completed BSc nursing 227(79.1%) (Table 1)

<table>
<thead>
<tr>
<th>Table 1: Socio Demographic Detail &amp; Work Profile</th>
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<tr>
<td><strong>Variable</strong></td>
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<tr>
<td>Age</td>
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<tr>
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<td>Education</td>
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<td>Work experience (in years)</td>
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<tr>
<td>Work experience (in other hospitals)</td>
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<td></td>
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<tr>
<td>Exposure history in the work place</td>
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</tbody>
</table>
Of the 287 nursing staff who were included and followed up for a period of six months there was a loss to follow up of 14 individuals with an attrition rate of 4.9% (Table 2).

The frequency of more than three episodes of illnesses was more among the following: 41 to 50 years age group, from medicine and allied departments, work tenure of 11-15 years, BSc nurses (Table 3).

Both working department and work tenure were found to be statistically significant in multivariate analysis (Table 4).

Multivariate regression analysis:

<table>
<thead>
<tr>
<th>Factors</th>
<th>OR</th>
<th>95% CI for OR</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Department</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation theatre</td>
<td>-</td>
<td>-</td>
<td>0.04*</td>
</tr>
<tr>
<td>Surgery &amp; allied department</td>
<td>6.47</td>
<td>1.4-29.1</td>
<td>0.01*</td>
</tr>
<tr>
<td>Medicine &amp; allied department</td>
<td>6.56</td>
<td>1.5-29.9</td>
<td>0.01*</td>
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<tr>
<td>Work tenure (in years)</td>
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<tr>
<td>1-5</td>
<td>1.74</td>
<td>0.96-3.14</td>
<td>0.06</td>
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<tr>
<td>6-10</td>
<td>4.2</td>
<td>1.5-11.7</td>
<td>0.006*</td>
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<tr>
<td>11-15</td>
<td>1.7</td>
<td>0.15-18.3</td>
<td>0.65</td>
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<tr>
<td>&gt;15</td>
<td>-</td>
<td>-</td>
<td>.030*</td>
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</tbody>
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*statistically significant at 5% level
Highest incidence rate of morbidity was noted in the age group of 31 to 40 years and the lowest in the age group of 21 to 30 years (Fig 1)

![Incident rate](image)

**Figure 1: Incidence rates of acute morbidity by age group**

Workers with work tenure of 11-15 years had reported more number of illnesses than other workers (Fig 2)

![Incident rate](image)

**Figure 2: Incidence rates of acute morbidity by work tenure**

**Profile of Acute Morbidites:** During the six months period of follow up of the study population, the commonest acute illness reported was upper respiratory tract infection (URTI) which accounted for 197 (34.3%), followed by myalgia, fever and backache which accounted for 93 (16.2%), 88 (15.3%) and 67 (11.6%) respectively. More than half (54.7%) of the illnesses were infectious like URTI, fever, acute gastroenteritis and LRTI. Nearly one third (30.6%) of morbidities were musculoskeletal disorders. Nearly 6(1%) nursing staff was found to have needle stick injury. Other morbidities included allergic reactions, gastritis, urinary tract infection, dysmenorrhea, white discharge per vagina, anxiety, stress and cut injuries

**Profile of Chronic Morbidities:** The prevalence of chronic morbidities among the study population was 84(29.32%). The most common health issue among nurses was found to be diabetes mellitus with a prevalence rate of 14 (4.9%) followed by hypertension with a prevalence rate of 12 (4.2%). Menstrual Irregularities 10 (3.5%), hypothyroidism 8(2.8%), shift work disorder 5(1.7%), heart disease 3(1.04%), bronchial asthma 3 (1.04), depression 3 (1.04%), CSOM 2 (0.7%). Other morbidities included refractive error, irritability and verbal abuse. Four staff nurses had taken treatment for tuberculosis. Chronic diseases like diabetes10(32.2%), hypertension 11(35.5%) and heart disease 3(9.7%) were found to be proportionately high among the nursing staff in the age group of 41-50 years. Among the nurses of age group 31-40 years 97.7% were fully immunized for hepatitis B and those between 41-50 years 100% were fully immunized.

Of all the 560 days of leave, 106 (19%) days constituted sick leave for various illnesses. The common morbidities for which leave had been taken in the study population were upper respiratory tract infection, fever, acute gastroenteritis and sinusitis. Leave frequency had significant association with various factors such as those who are not using PPEs, those who are not adherent to medications, those with back pain and those nurses with increased frequency of illness.

**Discussion**

Of the study population, 79.8% gave history of exposure to blood and body fluids in their work place which is similar to the study findings of Gourni P et al to assess the occupational exposure to blood and body fluids of nurses at emergency department in Attica, Greece where 87.1% of the participants reported exposure to blood or other liquids. In our study in spite of majority of the nurses using PPEs, they reported that they had exposure to chemicals and body fluids which can be explained by the fact that they were not using it throughout the working hours and also exposure not only involves hands and face, it may also involves other parts of the body.

About 54.7% of the illnesses were infectious, nearly 30.6% were musculoskeletal disorders and around 2% were allergic reactions and needle stick injuries. Similar findings were found in a cohort study done by Reis R J et al in 2007 in Brazil for 4 years which looked
into common morbidities among workers in a public hospital and reported that most common diagnoses were acute upper respiratory infection (14%) followed by dorsopathies, other soft tissue disorders and intestinal infectious diseases.

Needle stick injury was reported in workers in the age group of below 30 years, while it was absent in older age groups. Needle stick injuries seen only among younger age group can be attributed to less work experience. Also it is possible that senior do not give injections and are in more administrative roles in the wards – therefore leading to an apparently larger number of NSIs in the younger population. Similar finding was found in the study done by Cho E et al in South Korea on factors associated with needle stick and sharp injuries among hospital nurses where needle stick injuries were common among nurses with less work experience.5

Most of the acute morbidities reported were found to be increasingly common among workers of young age group and less work tenure. Another study conducted among paramedical staff in Public Hospitals of Jhelum in Pakistan showed there was an effect of age on the prevalence of occupational health hazards while work tenure itself has no significant effect on occupational health hazards.6

A study done to assess cardiovascular disease risks in health care workers in Mexico, showed that the prevalence of hypertension and diabetes was 22% and 8% which is high when compared to our study and also there healthcare workers had double the cardiac risk than expected for their age.7 Prevalence of hypothyroidism was found to be low in our study population as compared to another multi-centric, epidemiological study conducted in eight major cities among adult population in India which reported a prevalence of 10.95% and 9.2% among Bangalore population.8

Most importantly 4(1.4%) out of 287 nurses had history of treatment taken for tuberculosis infection in the past. Study done by Christopher DJ et al to assess the tuberculosis infection among young nursing trainees in South India showed a high prevalence of Latent Tuberculosis Infection (LTBI) (47.8%).9

Prevalence of diabetes and hypertension was high among nurses in the age group of 41-50 years. This is similar to the general population of India, where an International Diabetic Federation report states that almost half of all adults with diabetes are between the ages of 40 and 59 years.10

The significant association of leave frequency with seeking treatment regularly and increased frequency of illness was supported by the finding from a study conducted in the Netherlands which reported health complaints and consultations with the general practitioner as significant predictors of absenteeism.11

Our study findings are similar to the findings of the study conducted by Tripathi M et al to assess the absenteeism among nurses in a tertiary care hospital in India where about half the episodes of sickness were related to diseases of the respiratory tract, digestive system and infections.12

Recall bias could be one limitation. Therefore the incidence of acute morbidities may be under-reported. It is possible that workers took single day of leave (allowed casual leave) for illnesses and this may also result in the under-estimation of sick leave days.

Conclusion

Incidence rate of morbidity among nursing staff over a period of six months was 34.22 episodes per 100 person months. It was found that senior nurses of the age group 41-50 years and with work tenure of 11-15 years had more than three episodes of illness during the study period. Of the reported acute illnesses, more than half were infectious diseases, nearly one third were musculoskeletal disorders. Diabetes was the commonest chronic morbidity identified with a prevalence rate of 4.9% followed by hypertension and menstrual irregularities. Working in adverse settings and hazardous conditions are unavoidable for nursing staff, so it is crucial that nurses are protected. Therefore, they need to be sensitized and motivated about the use of personal protective measures especially throughout their working hours. Nurses should also be made aware of the common universal precautions. An issue of concern next to infectious diseases is ergonomics. Body mechanics is one component in which the nurse should have thorough knowledge and skill. Nurses .Training and educating the nurses on ergonomic issues–on correct seating, positioning while working, and correct way of handling and shifting patients.
Also WHO emphasizes that there is a need to educate the nurses on lifestyle and behavioural changes like diet, physical activity and on personal habits. Educational training programs should be multidisciplinary in the era of quality control to help healthcare workers realize the importance of basic infection-control policies in reducing morbidity and mortality and improving the quality of care.

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Conflict of Interest: Nil

Acknowledgements: Nursing Staff in the Tertiary care hospital

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Reproductive Health Education Intervention to Impact Awareness and Decision Making among Parents and Caregivers of Adolescent Girls with Cerebral Palsy: A Systematic Review

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ABSTRACT

Purpose: To assess the effect of reproductive health education intervention on awareness and decision making among parents and caregivers of girls with cerebral palsy

Parents of girls with cerebral palsy might have concerns regarding their child’s reproductive health issues like delayed menarche, menstrual hygiene, pelvic infection, future pregnancy, contraception for fear of sexual abuse. A systematic review will help gain evidence and plan a contextual intervention to address the needs.

Materials and Method: 11 leading medical and social electronic databases were searched between June 2017 to January 2019. Study designs included were Cohort, randomised controlled trials, pre-test and post-test, Controlled before and after studies, Quasi-experimental with any form of education intervention. Primary outcomes searched were increase in level of awareness, attitude and health seeking behaviour for reproductive health issues.

Results: Of the 1582 titles screened 41 abstracts were identified. 14 studies were found to have some relevant information but none of them revealed any statistical designed intervention answering the review question.

Conclusion: There is a paucity of literature which can show the effectiveness of health education interventions for parents to address reproductive health issues of girls with cerebral palsy.

Keywords: cerebral palsy girls, reproductive health education, parents and caregivers, adolescence, decision making.

Introduction

Adolescence is a transitional period and a child with disabilities undergoes emotional and mental changes to accept this transition.1 It has been estimated that globally there are about 220 million adolescents with disabilities of which 80% live in developing nations.2

As adolescence approaches for girls with cerebral palsy, parents and care givers can approach health care providers for information pertaining to menstrual hygiene, coping methods, medical suppression, etc. Anticipatory guidance can help make informed choices by parents as the girls themselves can’t participate in decision making for her health.3 Studies has revealed that internet has been found to be source of information by parents and care-givers for reproductive health issues, thereby, emphasising the role of health care providers to play a pro-active role

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to improve the psychological, physical and social health of families of girls with disabilities. Sometimes parents can prioritise physical disability over menstrual issues for lack of resources but a comprehensive care of such girls includes increasing awareness among the care givers regarding menstrual issues. It has been emphasised that individual approach might be needed to address menstrual issues in this population after allowing the girls to go through puberty but there is lack of guidelines for health care providers to choose a specific method when the parents approach them due to lack of sufficient evidence pertaining to these issues. Studies have revealed that parents takes steps to promote the health of their girls with disabilities so that they are socially included, their nutrition and physical activity. Given these circumstances it is necessary that health personnel should join hands with them to encourage their attitude and increasing their knowledge towards reproductive health issues. Research also has revealed that parents and health providers have felt that they felt uninformed and underprepared to deliver reproductive health education to these children with disabilities so that they can make informed choices and decisions when it comes to their sexual life. Parents have opined it is the doctor's responsibility to provide such information and thereby there is a lack of informal source of reproductive health information for children with disabilities. Interdisciplinary approach adopted to address the reproductive health concerns of a small number of mentally handicapped population have shown satisfaction and acceptability among the patient, family and the community but similar such evidence pertaining to adolescents with cerebral palsy seems to be lacking. Early education of disabled female adolescents and their families regarding menarche, menstrual hygiene and sexual health will help prepare them better for the transition to adulthood but necessary training of the clinicians is necessary in this regard. This reinforces the need of evidence for designing modules of education intervention to address the reproductive health concerns which help in enhancing the awareness and health seeking behaviour among the parents of girls with cerebral palsy.

Material and Method

The Preferred Reporting Items for Systematic Review and Meta Analysis guidelines have been adhered to and this systematic review has been registered in the international prospective register of systematic reviews (PROSPERO) database in May 2017 (Reg no - CRD42017059072).

Eligibility criteria:

Types of studies: All published Cohort, randomised controlled trials, pre-test and post-test, controlled before and after studies, quasi-experimental studies and qualitative studies were systematically searched in this review. During the search process, no methodology filters were used so that all type of studies could be included.

Types of participants: Parents and caregivers of girls with cerebral palsy were included for the review. Studies on parents of children with other reasons for developmental delay and parents of boys with cerebral palsy were excluded. Studies among adults of cerebral palsy were also excluded for the present review.

Types of interventions: Parental education intervention in the form of training, lectures, films, role plays, group discussions, workshops, counselling, health education material, family centred services, mass media were all included for the present review.

Outcomes: The primary outcomes looked for was increased level of knowledge and awareness among parents and caregivers regarding reproductive health issues among their girls which influenced their decision making regarding those issues. The secondary outcomes were 1) change in attitude towards reproductive health issues 2) positive coping measures adopted 3) and health seeking behaviour for reproductive health issues.

Information Sources and search: A total of 11 medical, psychological and social electronic bibliographic databases were searched: PubMed, Cochrane Library, Web of Science (Web of Knowledge), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Science Direct, PROQUEST Health and Medical Complete (Proquest Medical Library), SCOPUS, Springer, Google Scholar, Oxford Journals(Medicine and Health), GREYNET online. The reference lists of potential studies were also screened to identify other relevant studies. Keywords and Medical Subject Headings (MeSH) were used to identify studies related to education intervention for parents and care givers of girls with cerebral palsy. The month of the last search was January 2019. There were no restrictions by study setting and country. All studies in English language were included. The literature search was not limited by date.

Study selection: Two reviewers (APR, NV) screened the search results first by titles followed by abstracts. Any
disagreement and discrepancy was resolved with other reviewer(NR). No study was excluded when the outcome of interest was not identified in either title or abstract. In order to import, classify and analyse all citations in the current review, the reference management software used was ENDNOTE X7. In every database, all citations were imported to ENDNOTE X7 and saved by date of searching and respective database. Whenever available, abstracts were also imported. Abstract screening and data collection was done independently by both reviewers and any discrepancy was resolved with other reviewers. Outcomes and measurement of outcomes were assessed. It was planned to assess the risk of bias corresponding to different study designs. However, as tools of National heart, lung and blood institute, for included studies using the study quality assessment and data collection was done independently by both abstracts were also imported. Abstract screening reviewers and any discrepancy was resolved with other reviewers. Outcomes and measurement of outcomes were assessed. It was planned to assess the risk of bias for included studies using the study quality assessment tools of National heart, lung and blood institute, corresponding to different study designs. However, as none of the studies found inclusion to the review, risk of bias assessment activity was not undertaken.

**Results**

A total of 1582 citations were retrieved during database searches. After removal of duplicates 1220 citations were identified. 41 titles were identified to be potential for abstract screening. All the abstracts were obtained and data was retrieved by one reviewer and the content was independently reviewed by the other reviewers.

A total of 13 abstracts were selected for full text screening to identify data pertaining to the review question. Full length article screening was done independently by both reviewers and it was found that none of the studies exercised an intervention, exclusively to address reproductive health issues and measured the increase in awareness and influence on decision making of parents and caregivers of girls with cerebral palsy. However, 2 studies were identified which emphasised the importance of an intervention and the possible effect it can produce. In the first study, even though an intervention was not conducted in a statistical way to assess the effect, it revealed that menstrual concerns were the primary reason among parents for seeking advice and education of the families with expectant management of menstrual concerns was tried but it did not reveal for how long and what was the impact of the intervention. The second study, where a survey was conducted among parents and caregivers of girls with cerebral palsy revealed that information was sought by considerable number of parents prior to menarche which they believed was essential to be known.

**Discussion**

The objective of the present study was to assess the various reproductive health education interventions for parents of girls with cerebral palsy which can bring about a change in their awareness and help decision making pertaining to the child’s health. Unfortunately, we could not find any study which had executed an education intervention exclusively for reproductive health information and assess the change in a scientific manner. This was slightly unexpected as we were hopeful given the number of studies on educating parents of children with cerebral palsy regarding their clinical condition Reproductive issues have been addressed among adult women with cerebral palsy than adolescent girls with cerebral palsy. An intervention done when the girl is an adolescent can help prepare the family to address the menstrual issues and for the girl to be more equipped to make decisions for her reproductive life in future. Studies have been published which recommend and guide the health care practitioners in case of menstrual concerns among girls with developmental delays. Studies have been conducted to emphasise the role of family and social support that a child of cerebral palsy depends on for a healthy living. When all of them are important stakeholders in the daily life of the girl child, an opportunity would be missed when the parents are expected to approach themselves for suggestions regarding menstrual difficulties. Studies have also revealed that some parents were undecided for menstrual management inspite of an informal counselling. More preparedness and training with multidisciplinary approach should be present on the part of the health care providers but this requires evidence which proves the beneficial effects of a reproductive health education on families of girls with cerebral palsy. Research has revealed that parents of cerebral palsy girls have understood that it is not their responsibility and awareness for the girls regarding menstrual issues have to be provided by qualified people rather than themselves while practitioners are also seeking different professionals. Parents in the past have approached for information even before the girl has attained menarche and research has shown that the chances of an early puberty among these girls are higher compared to their normal counterparts in the community.
Even though parents have been given an opportunity to express their needs and concerns addressed, anonymising and incorporation of their queries as an educational programme was never addressed. Education intervention through mass media was not much expected to be seen as parents might prefer confidentiality of information probably due to stigma.

Family centred services for families with children of cerebral palsy have proven to have a positive impact on the psychosocial health and well being of the family and involvement of parents in decision making cannot be overemphasised. Parents of these children are physically and psychologically strained and are in need of guidance, support for management of all the needs, especially in resource poor settings. Efforts have been made to educate an adolescent girl with cerebral palsy regarding menstrual and sexual concerns but among girls with higher stages of GMFCS and mental retardation parents will have to take the decisions for the child. The present study reveals that there is a lack of literature which are trying to assess and analyse the effectiveness of a health education intervention for parents to address the reproductive and sexual health issues of their girl children with cerebral palsy. However, the present review has not included those studies if health education was addressed to parents of or exclusively to adult women with cerebral palsy.

**Conclusion**

There is need for an exclusive health education intervention for parents and caregivers of adolescent girls with cerebral palsy which can enhance their confidence to deal and address the reproductive health needs of their differently abled child. This can have a positive influence on the family with respect to parents’ psychosocial health as well as the girl child. In turn this can enhance the adolescent girl’s confidence of a strong family support. Although it has been executed in an informal way when there has been enquiries from the parents and the caregivers, a scientific study will help prove the significance of such an intervention and evidence for further recommendations.

**Conflict of Interest:** The authors declare no conflict of interest

**Source of Funding:** Self

**Ethical Clearance:** Institutional Ethical Clearance was obtained prior to commencement of study (IEC no: 345/2015)

**REFERENCES**


Internal Quality Control for Urea and Creatinine in Cobas 6000 Analysers Using Serum Sample

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ABSTRACT

Introduction: Quality control is an integral part of the analytical laboratory to obtain a precise, accurate result and also to reduce errors. Many national level laboratories utilize internal and external quality control methods for this purpose. The commercially available quality materials used for assessing daily internal quality control (IQC) is expensive, and hence in this study, an attempt was made to know the usefulness of serum sample as a quality control material.

Objective: To study IQC for urea and creatinine in Cobas 6000 analyser using serum sample

Materials and Method: The study was conducted in the Clinical Biochemistry Laboratory, Kasturba Hospital, Manipal Academy of Higher Education, Manipal. IQC for estimation of urea and creatinine was assessed using Cobas 6000 -1 and compared with Cobas 6000 - 2 autoanalyser. Thirty anonymised fresh serum samples and quality control material from Biorad with two level were used and compared between two analysers. Bland Altman agreement statistical analysis was applied for evaluating comparability using SPSS version 15.

Result: Quality control materials with two levels and serum samples showed good concordance for most of the urea and creatinine values, and all values were within 2SD. Mean difference for estimation of urea with serum sample was found to be 0.03 with 95% limit of agreement from -2.67 to -2.73. Mean difference for estimation of creatinine with serum sample was found to be 0.012 with 95% limit of agreement from 0.235 to -0.26.

Conclusion: Our study showed that the fresh serum samples could be used as an IQC when control materials are not available or available one is deteriorated. An important implication of the study findings is that using serum samples for IQC will appreciably lower the cost for validation of the accuracy of the autoanalysers.

Keywords: Bland Altman, quality control, quality assurance, quality control material, reference material

Introduction

The kidney is the vital organ which performs many functions such as water balance, electrolyte balance, acid-base balance and secretion of hormones. Serum creatinine, urea, uric acid, electrolytes are the commonly used biochemical parameters to assess the functioning of the kidney. Among the parameters mentioned above urea and creatinine are widely used, and several manual methods are utilised for its estimation in diagnostic laboratories for many years1-3. Now-a-days, due to an overwhelming sample load, these time-consuming methods are replaced by automated analysers to obtain the result of more samples in a short time4. The ultimate goal of either of these processes is to release accurate results. In any clinical laboratory internal or external quality control (EQC) is crucial to ensure the release of accurate and precise laboratory results. As per R J
Lock’s article published in the year 2006, internal quality assurance is beneficial in early identification of the problem and the initiation of corrective action\textsuperscript{7}. Internal quality control can be used to evaluate the quality of analysis by six sigma\textsuperscript{8}. Six sigma is widely used in industry and business for the management of quality. It provides more framework for evaluating process performance and process improvement\textsuperscript{9}. As maintaining EQC is expensive incorporating internal quality control (IQC) in the analytical laboratory may be beneficial in this regard\textsuperscript{9,8}. Many methods are used for this purpose, they are patient data, individual patient result, clinical correlation, correlation with other laboratory test results, intralaboratory duplicates, delta check with previous test results, limit checks, using commercially available control materials\textsuperscript{8}. Among them commercially available materials are used in good quality laboratories but they are expensive and deteriorate faster. Hence, an attempt was made to evaluate the usefulness of utilising serum samples to maintain daily IQC processes.

**Materials and Method**

The cross-sectional study was conducted in the Clinical Biochemistry Laboratory of tertiary care centre during the period September 2014 to March 2015. Usefulness of internal quality control using anonymized serum sample was studied for estimation of urea and creatinine in Cobas 6000- 1 and Cobas 6000-2 autoanalyzer.

**Analyzer and Methods Description:** Cobas 6000 analyser with a single loading point was used in our study. We used anonymized serum samples, commercial lyophilized assayed chemistry quality control material with level 1 and level 2 obtained from Biorad company for the measurement of urea, creatinine. Nonlipemic, nonhemolytic leftover fresh anonymised serum samples irrespective of an individual with a routine examination or diseased condition, preferably collected before 10 am from all age groups and both sexes were included and processed within an hour of receipt. Urease GLDH method is used for the estimation of urea\textsuperscript{10,11}. This enzymatic method based on the principle where a decrease in NADH concentration in unit time is proportional to the urea concentration. Jaffe’s method was used for the estimation of creatinine\textsuperscript{12,13}. In this method creatinine at alkaline pH reacts with the picric acid, forming an orange coloured compound creatinine picrate which can be measured colorimetrically at 540 nm. The intensity of the color is directly proportional to the concentration of creatinine in the serum sample.

**Protocol:** The control samples were reconstituted as per the provider instructions. After reconstitution, the shelf life of each control sample is 30 days at -20°C. The controls were run in Cobas 6000-1 and Cobas 6000-2 analyzers daily before running the patient samples. For this study, the left over anonymised serum samples were selected as per inclusion criteria. A total of 30 serum samples each for estimation of urea and creatinine were included and used for the estimation on both analyser. The results obtained with controls level 1 and 2, and the serum sample for urea and creatinine level were recorded.

**Statistical Analysis**

The obtained values for urea and creatinine were entered in SPSS version 15 software for statistical analysis. The Bland-Altman method is a graphical method used to compare two measurements of the same variable. It is also utilized to see the difference between the two instruments. In this graph mean of each pair of measurements plotted on x-axis versus the difference between the measurement on y-axis. In our study, we used this graphical method to analyse the IQC for urea and creatinine using anonymised serum sample and QC material. Average urea and creatinine results of 30 serum samples, level 1 and level 2 controls on both the analysers were plotted.

**Results**

Means of each pair of measurements (x value) versus the difference between the measurements (y value) were plotted using Bland Altman graph. Urea Level 1 of Quality control material results on both the analysers were plotted against the difference between them. The mean is 0.133, lower and upper limit is -1.32 and 1.59 (table/fig.1). Mean of the Urea Level 2 Quality control material results on both the analysers were plotted against the difference between them. The mean is 0.2, lower and upper limit is -4.99 and 5.19 (table/fig.2). Mean of the Urea in serum sample on both the analysers were plotted against the difference between them. The mean is 0.03, lower and upper limit is -2.73 and 2.67 (table/fig.3). Mean of the Creatinine Level 1 Quality control material results on both the analysers were plotted against the difference between them. The mean is 0.0040, lower and upper limit is -0.152 and 0.144 (table/fig.4). Mean of the Creatinine Level 2 Quality control material results on both the analysers were plotted against the difference between them. The
mean is 0.018, lower and upper limit is -0.183 and 0.219 (table/fig.5). Mean of the Creatinine in serum sample on both the analysers were plotted against the difference between them. The mean is 0.012, lower and upper limit is -0.26 and 0.235 (table/fig.6). In the graph most of the observed values lies between the control limit and hence the method the functioning properly.

**Figure 1:** Urea Level 1 Quality control on Cobas 6000 1 and 2 analysers.

Mean of the Urea Level 1 Quality control results from both the analysers were plotted against the mean difference between two analyser. Bland–Altman plot of agreement between two analysers for Urea Level 1 Quality control was found to be 0.133 ± 1.457 (95% confidence interval, upper limit is -1.32 to 1.59, and mean 0.133)

**Figure 2:** Urea Level 2 Quality control on Cobas 6000 1 and 2 analysers.

Mean of the Urea Level 1 Quality control results on both the analysers were plotted against the mean difference between two analyser. Bland–Altman plot of agreement between two analyser for Urea Level 2 Quality control was found to be 0.2 ± 4.99 (95% confidence interval, upper limit is -4.79 to 5.19, and mean 0.2)

**Figure 3:** Estimation of Urea by serum sample on Cobas 6000 1 and 2 analysers. Mean of the Urea in serum sample on both the analysers were plotted against the difference between result of two analyser. Bland–Altman plot of agreement between two analyser for Urea in serum sample was found to be 0.03 ± 2.64 (95% confidence interval, upper limit is -2.61 to 2.67 and mean 0.03)

<table>
<thead>
<tr>
<th>Analyte Urea</th>
<th>Control Level 1</th>
<th>Control Level 2</th>
<th>Serum sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean of difference</td>
<td>0.133</td>
<td>0.2</td>
<td>0.03</td>
</tr>
<tr>
<td>Mean + 2SD</td>
<td>1.59</td>
<td>5.19</td>
<td>2.67</td>
</tr>
<tr>
<td>Mean – 2SD</td>
<td>-1.32</td>
<td>-4.79</td>
<td>-2.61</td>
</tr>
</tbody>
</table>

**Figure 4:** Creatinine Level 1 Quality control on Cobas 6000 1 and 2 analysers.

Mean of the Creatinine Level 1 Quality control results from both the analysers were plotted against the mean difference between them. Bland–Altman plot of agreement between two analysers for Creatinine Level 1 Quality control was found to be 0.004 ± 1.44 (95% confidence interval, upper limit is -1.44 to 1.59, and mean 0.004)
Figure 5: Creatinine Level 2 Quality control on Cobas 6000 1 and 2 analysers.

Mean of the Creatinine Level 2 Quality control results on both the analysers were plotted against the difference between them. - Bland–Altman plot of agreement between two analysers for Creatinine Level 2 Quality control was found to be 0.018 ± 1.44 (95% confidence interval, upper limit is -0.183 to 0.219 and mean 0.018). The lower and upper limit is -0.183 and 0.219.

Figure 6: Estimation of Creatinine in serum sample on Cobas 6000 1 and 2 analysers. Mean of the Creatinine in serum sample on both the analysers were plotted against the difference between them. The lower and upper limit is -0.26 and 0.235.

Table 2: Mean of difference between control level 1, level 2 and serum sample for Creatinine

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Control Level 1</th>
<th>Control Level 2</th>
<th>Serum sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean of difference</td>
<td>0.004</td>
<td>0.018</td>
<td>0.012</td>
</tr>
<tr>
<td>Mean + 2SD</td>
<td>0.144</td>
<td>0.219</td>
<td>0.235</td>
</tr>
<tr>
<td>Mean – 2SD</td>
<td>-0.152</td>
<td>-0.183</td>
<td>-0.26</td>
</tr>
</tbody>
</table>

Discussion

Urea and creatinine are the useful biochemical parameters utilized for assessing the kidney function for diagnosis of kidney disorders, as well as for the prognosis and monitoring drug therapy. Manual methods used for these methods are time-consuming and needs more sample. Automated techniques are beneficial in this regard and have helped to overcome these problems. While using any analyser, it is essential to know the accuracy of the analyser on a day-to-day basis even after initial validation by the company personnel. Both or either IQC or EQC measure is used to assess the accuracy of any biochemical parameter. IQC materials are available commercially with metrics same as a serum sample and are with different levels. These materials are run by the National Accreditation Board for Testing and Calibration Laboratories (NABL) guidelines and interpreted by using Levy Jenning’s chart or Westguard rules. However these methods were used by only some sophisticated laboratories since they are expensive and not affordable by all. Also nowadays the cost of healthcare has more priority, and hence it is required to use less expensive methods both to reduce the errors and cost in laboratory analytical methods. A study used the pooled patient sample as IQC material for the estimation of canine acute phase protein sample and found that it showed good analytical performance. A similar study by Patil A et.al, in the year 2013 utilized patient blood sample as IQC material for the determination of erythrocyte sedimentation rate(ESR) and found it to be very precise. Another study by Kahtri et.al, in 2013 used pooled serum samples as IQC material and found to be useful for small laboratories. In the present study, we found that both QC material with two levels and serum samples showed good concordance for most of the urea and creatinine values. Hence serum samples can be used as reference material to conduct IQC analysis. In laboratories with large sample load QC has to be done in
between the sample load. In such cases, serum samples can also be used to maintain the internal quality to reduce the cost. However for urea, we found that most of the points are present within 2 standard deviations (SD) from the mean except two points observed in the serum sample graph, which exceeded the plus-minus 2SD limit. For creatinine, all points except one in the level 2 quality control and one in the serum sample exceeded the desired limit. Presence of biochemical substances such as high bilirubin, free haemoglobin, lipid, protein, patient medication, etc. impairs the quality of result 20. Along with this many other cofactors also alters the test report other than the analytical process 21. The study found that Internal quality material prepared from routine serum/plasma samples stored at -20°C may be cost-effective when compared to commercially available one 22. We could not study the effect of interfering parameters and frozen sample in our present work.

**Conclusion**

From our present study it is evident that fresh serum samples can be used as an IQC when control materials are not available or available one is deteriorated. However, we could not monitor possible other confounding biochemical parameters in the serum sample and usefulness of frozen serum sample which is needed to be addressed further.

**Conflict of Interest:** There is no conflict of interest.

**Source of Funding:** No funding

**Ethical Clearance:** Ethical clearance was obtained from Institutional Research committee, MAHE, Manipal

**Acknowledgement**

We acknowledge Dr. Pargna Rao, Dean and Professor in Biochemistry, Kasturba Medical College Manipal, Manipal Academy of Higher education, Manipal for the constant support during this study.

**References**


Laser Treatment in Dentistry—A Review

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ABSTRACT

The term LASER is an acronym for 'Light Amplification by the Stimulated Emission of Radiation'. In the last two decades, there has been an explosion of research studies in laser application. It has been used widely in a range of biomedical and dental applications in recent years. The main benefits for laser applications are patient comfort, pain relief and better results during specific applications. Major concerns for using dental lasers are high cost, need for specialized training and sensitivity of the technique, thereby compromising its usefulness particularly in developing countries. Since a remarkable increase in the use of lasers for dental application is expected in the near future, this paper aims to review on laser treatment effectiveness and its applications.

Keywords: laser, dentistry, surgery

Introduction

The term LASER is an acronym for 'Light Amplification by the Stimulated Emission of Radiation' and was first introduced to the public in 1959, in an article by a Columbia University graduate student, Gordon Gould. In the history of laser treatment evolution, in 1961, a laser generated from crystals of yttrium-aluminum-garnet treated with 1-3% neodymium (Nd: YAG) was developed. In 1962, the argon laser was developed, whereas, the ruby laser became the first medical laser to coagulate retinal lesions, when it was used in 1963. In 1964, Patel at Bell Laboratories developed the CO₂ laser. Nowadays diode lasers are being extensively used in the field of dentistry.

There are two scenarios, on the one hand there are hard lasers, such as, Carbon dioxide (CO₂), Neodymium Yttrium Aluminum Garnet (Nd: YAG), and Er:YAG, which offer both hard tissue and soft tissue applications, but have limitations.

A major diagnostic application of low power lasers is the detection of caries, using fluorescence elicited from hydroxyapatite or from bacterial by-products. Laser fluorescence is an effective method for detecting and quantifying incipient occlusal and cervical carious lesions, and with further refinement could be used in the same manner for proximal lesions. Photoactivated dye techniques have been developed which use low power lasers to elicit a photochemical reaction. Photoactivated dye techniques can be used to disinfect root canals, periodontal pockets, cavity preparations and sites of peri-implantitis. Resin composites need to be polymerized to form a flowable plastic mass to a solid restoration. Other restorative dentistry procedures include extrinsic teeth stains using bleaching agents, endodontic treatments and indirect restorations manufactured in the dental laboratory.

Basic Principle of Laser: A laser beam discharges photons in the form of a focused, coherent and monochromatic energy ray that interacts with a target

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tissue such as dental material. When a laser interacts with oral tissues, there are four possible outcomes: transmission, reflection, scatter and/or absorption as illustrated in figure 1. Cutting of soft tissues and ablation of hard tissues is dependent upon the ‘absorbance’ of light by the targeted tissues.\(^5\)

**Figure: 1**

![Laser interaction with tissues](image)

**Fig. 1: Laser interaction with tissues produces four possible outcomes: transmission, reflection, scatter and/or absorption**

Transmission occurs when there is no interaction between the tissues and the laser. When transmitted, due to the difference in the refractive indices of air and the tissue, some light is refracted.\(^6\)

Reflection is a possible outcome of a laser-tissue interaction in which the laser beam is deflected back instead of being absorbed. In dental lasers, the laser light is delivered from the laser to the target tissue via a fiberoptic cable, hollow waveguide, or articulated arm. An energy source, an active lasing medium, and two or more mirrors that form an optical cavity or resonator.\(^7\) For amplification to occur, energy is supplied to the laser system by a pumping mechanism, such as, a flash-lamp strobe device, an electrical current, or an electrical coil. This energy is pumped into an active medium contained within an optical resonator, producing a spontaneous emission of photons. Subsequently, amplification by stimulated emission takes place as the photons are reflected back and forth through the medium by the highly reflective surfaces of the optical resonator, prior to their exit from the cavity via the output coupler.\(^8,9\)

**Laser-tissue Interaction:** Each wavelength has a somewhat unique effect on dental structures because of the specific absorption of that particular laser energy in the tissue. Some lasers are only absorbed by blood and tissue pigments, while others are only absorbed by water as well as “hard” tissue, such as enamel, dentin, and bone. Lasers produce light energy that can be absorbed by a target tissue, and this absorption process produces a thermal reaction in that tissue. Absorption requires an absorber of light, termed chromophores, which have a certain affinity for specific wavelengths of light. The primary chromophores in the intraoral soft tissue are Melanin, Hemoglobin, and Water, and in dental hard tissues, Water and Hydroxyapatite.\(^{(fig-2)}\) Different laser wavelengths have different absorption coefficients with respect to these primary tissue components, making the laser selection procedure-dependent.\(^{(6,10)}\)

![Laser/tissue interaction between different types of laser](image)

**Figure 2: Laser/tissue interaction between different types of laser**

Depending on the instrument’s parameters and the optical properties of the tissue, the temperature will rise and various effects will occur. In general, most nonsporulating bacteria, including anaerobes, are readily deactivated at temperatures of 50° C. The inflammatory soft tissue present in periodontal disease can be removed with a temperature of 60° C; moreover, hemostasis
can also be achieved within the same heat parameters. Laser excisional or incisional surgery is accomplished at 100° C, where vaporization of intra- and extracellular water causes ablation, or removal of biological tissue. At this temperature, the aqueous component of tooth structure and bone also boils; thus cavity preparation, calculus removal, and osseous contouring can proceed. There are significant differences in the depth of penetration of the laser beam. Diode and Nd:YAG energy can penetrate a few millimeters into the tissue and carbon dioxide’s radiation will travel about 0.5 millimeters; however, the erbium wavelengths are absorbed on the surface of the tissue with a depth as little as 5 microns.\textsuperscript{11,12,13}

**Advantages and Limitations of Lasers:** Clinicians must provide quality oral health care based on individual state practice acts and in accordance with other regulatory bodies. It is imperative that the dental practitioner deliver competent dental care in accordance with their education, training, and clinical experience. Dental lasers will become the standard of care for assuring reproducible outcomes for many procedures; practitioners are advised to stay current with new treatment modalities.

Oral surgery procedures that require the removal of soft tissue can be achieved by vaporization (ablation) and/or cutting (incision, excision, or dissection) with the diode laser. Some of these soft-tissue applications include but are not limited to gingivectomy, frenectomy, hemorrhagic lesion removal, gingival sculpting techniques associated with implant recovering or therapy, and subgingival curettage.\textsuperscript{14}

The advantages for laser soft-tissue oral surgery include improved hemostasis, reduced intraoperative and postoperative pain/discomfort, decreased postoperative swelling, eliminated need for sutures, reduced bacterial count at the wound site, reduced operator time, and versatility. Because of its versatility, this laser may be a useful alternative for soft-tissue oral surgery compared to traditional periodontal surgery.

The disadvantages or limitations of laser surgery compared to incisions made by scalpel include slower tissue cutting, delayed healing, and reduced surgical precision.\textsuperscript{15} There are some disadvantages to the current dental lasers, which only emit energy from the tip of the delivery system. In that sense, they are all “end cutting,” which usually means a modification of the practitioner’s clinical technique. Although they are useful for caries removal and tooth preparation, the erbium family of lasers is unable to remove gold and vitreous porcelain, and has only a small interaction with amalgam. Of course, that fact is also an advantage when treating a recurrent carious lesion adjacent to a veneer or crown, for example, since there will be no interaction with the restorative material. However, most composite restorations can be ablated.

One of the main benefits for using dental lasers is the ability to precisely interact with and, in some cases, remove a few cell layers at a time. Erbium lasers can have some selectivity in removing diseased tooth structure because carious lesions have a much higher water content than healthy tissue. Studies have shown other advantages over conventional high-speed handpiece interaction on the tooth surface, such as the elimination of micro-fractures and a reported lowering of pulpal temperature as the preparation proceeds. Osseous tissue removal and contouring can also proceed easily with reported faster healing. Moreover, it has been demonstrated that the lased enamel has a good potential for bonded restorations as long as they are subsequently etched with acid.

With good control of bleeding, visualization of the surgical field is greatly improved, and many laser procedures can be performed with less injectable anesthesia. In those situations, additional treatment may be performed in the same appointment. Furthermore, initial postoperative discomfort and swelling are reduced because of the sealing of nerves and lymphatics.

McDonald and Pitt Ford found that the human pulpal blood flow was decreased when continuous light tipping forces were applied to a maxillary canine. Barwick and Ramsay evaluated the effect of a four minute application of intrusive orthodontic force on human pulpal blood flow with laser-Doppler flowmetry and concluded that the pulpal blood flow was not altered during the application of a brief intrusive orthodontic force.\textsuperscript{16,17} Low energy laser irradiation stimulates the velocity of tooth movement via the expressions of M-CSE.\textsuperscript{18}

**Laser Safety:** It is critical that all protective eyewear worn is wavelength-specific. Additionally, accidental exposure to the non-target tissue can be prevented through the use of warning signs posted outside the nominal hazard zone, limiting access to the surgical environment, minimizing the reflective surfaces, and ensuring that the laser is in good working order, with all manufacturer safeguards in place. With regard to prevention of possible exposure to infectious pathogens, high volume suction should be used to evacuate any vapor plume created during
tissue ablation, and normal infection protocols should be followed. Each office should have a designated Laser Safety Officer to supervise the proper use of the laser, coordinate staff training, oversee the use of protective eyewear, and be familiar with the pertinent regulations. While most dental lasers are relatively simple to use, certain precautions should be taken to ensure their safe and effective operation.

### Laser Hazards:

**Primary Hazards:** Caused directly by laser beam. Endangers mainly two organs- Eyes and Skin In case of eyes it damages retina, cornea, & the lens and slight carelessness can destroy vision permanently.

**Secondary Hazards:** Its related to operation of the laser and are independent of radiation characteristics.

<table>
<thead>
<tr>
<th>Laser</th>
<th>Eye parts</th>
<th>Eye Damage</th>
<th>Skin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argon 488-514 nm</td>
<td>Retina</td>
<td>Retinal Lesion</td>
<td></td>
</tr>
<tr>
<td>Caries detection and oral pathology cytofluorescent devices 630-900 nm</td>
<td>Lens (above 700nm)</td>
<td>Retinal lesion Retinal Burn and Cataract (above 700nm)</td>
<td></td>
</tr>
<tr>
<td>Diode 810-980 nm</td>
<td>Retina and lens</td>
<td>Retinal Burn and Cataract</td>
<td></td>
</tr>
<tr>
<td>Nd:YAG 1064nm</td>
<td>Retina and Lenses</td>
<td>Retinal Burn and Cataract</td>
<td></td>
</tr>
<tr>
<td>Ho:YAG 2100 nm</td>
<td>Lens, Aqueous Humor and cornea</td>
<td>Cataract, Aqueous flare Corneal Burn</td>
<td></td>
</tr>
<tr>
<td>Er,Cr:YSGG 2780 nm</td>
<td>Lens, Aqueous Humor cornea</td>
<td>Cataract, Aqueous flare, Corneal Burn</td>
<td></td>
</tr>
<tr>
<td>R:YAG 2940nm</td>
<td>Lens, Aqueous Humor Cornea</td>
<td>Cataract, Corneal burn, Cataract</td>
<td></td>
</tr>
<tr>
<td>CO₂10,600nm</td>
<td>Cornea</td>
<td>Corneal burn</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion**

There is a leaning curve in the use of lasers in dentistry. As long as the clinician has completed a training course & proceeds through the learning curve at a comfortable pace, the rewards will quickly be noticed by the patient and the dental team. Use of Laser in dentistry is proved to be advantageous in treating a wide range of dental conditions as well as a therapeutic tool in tissue management. Laser technology for hard tissue application and soft tissue surgery is at a high state of refinement, having had several decades of development, up to the present time, and further improvements can occur. The field of laser-based photochemical reactions holds great promise for proper safety management requires a fourfold approach including: knowledge of standards, identification of hazards and risks, implementation of appropriate control measures, and consistent program audit to demonstrate quality assurance. Additional applications, particularly for targeting specific cells, pathogens, or molecules. There is a leaning curve in the use of lasers in dentistry. As long as the clinician has completed a training course & proceeds through the learning curve at a comfortable pace, the rewards will quickly be noticed by the patient and the dental team.

**Source of Funding:** Self

**Conflicts of Interest:** None

**Ethics Clearance:** Not obtained as it is a review study.

### REFERENCES

Effect of Complete Denture Prosthesis on Speaking Rate in Edentulous Individuals

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ABSTRACT

Aim: The aim of the study was to evaluate the speaking rate without dentures and post denture insertion among the geriatrics.

Method: A total of (N=20) aged 60-75 years, requiring removable complete denture prosthesis were recruited. The speech rate was recorded using Motor Speech Profile program.

Results: The speaking rate was slower among the geriatric group compared to the control. However the mean speaking rate was found to be better with denture insertion as compared to without dentures thereby improving the speech intelligibility.

Conclusions: It is recommended to draw attention to possible speech problems post rehabilitation with the complete dentures.

Keywords: Speaking rate, Denture Insertion, Motor speech Profile

Introduction

Edentulism is the state of having lost all of one’s natural teeth. [1] The prevalence of complete or partial edentulism increases with age. This complete or partial loss of teeth and associated structures can adversely affect the speech production in them. The most common replacement modality for such loss of teeth is fabrication of removable complete denture prosthesis. It has been reported that the insertion of new dental prostheses can lead to speech problems and also a period of functional and psychosocial adaptation.[2] Being self-assured and contented for a stable and well-fitting restoration is a key to active participation in a social environment especially in the aged. The ability to speak without restrictions is largely determined by the quality of the prosthetic restoration. Studies have shown that speech adaptation for most complete denture–wearing individuals will be completed within one month, but some may experience speech difficulty for more than 6 months, [2] and others continue to have problems even after one year.[3] Hence the aim of this study was to evaluate the speaking rate of new denture wearers before, immediately after and after two weeks of complete denture insertion and also to compare the speaking rate of males and females.

Method

This prospective case-control study was conducted after obtaining the ethical clearance. Written informed consent was obtained from the participants. A total of 20 participants (10 males and 10 females) in the age range
of 60-75 years. All the participants were edentulous for a period of 6-12 months and were first time denture wearers. A group of 10 dentulous males and females of same age group served as control. All the participants were native Kannada speakers, with local dialect. The participants with inherent speech or hearing disorders, defects affecting denture stability were excluded.

Procedure: Conventional prosthodontics was followed in the fabrication of new complete maxillary and mandibular dentures. To obtain the baseline data, prior to the denture insertion, speech rate was assessed using Motor Speech Profile (MSP) (CSL model 4150: Kay Elemetrics corp, USA). MSP is most commonly used software to analyze motor speech behavior. The speaking rate was measured using the Standard Syllabic Rate Protocol. This protocol assesses the client’s speech rate using a standard target sentence. The speech was recorded in a sound treated room using a dynamic microphone at a constant distance of 10cm from the participant’s mouth. The stimuli “vondu aadu bettada nettiyalli meyuthithu” from the standard reading passage of Kannada language with English meaning “sheep was grazing on top of the hill” was used. The polished dentures were then inserted and speech recording was repeated. The next recording was scheduled after two weeks of denture use.

Results

The speaking rate was evaluated among the completely edentulous participants pre, immediately after and two weeks post insertion of complete denture prosthesis. Statistical package SPSS 13.0 software was used for statistical analysis. A value of p<0.05 was considered to be statistically significant.

Table 1: Comparison of speaking rate without dentures, immediately after and two weeks post insertion among males and females

<table>
<thead>
<tr>
<th>Gender</th>
<th>Situation</th>
<th>No</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Anova F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>Without dentures</td>
<td>8</td>
<td>2.02588</td>
<td>.467901</td>
<td>2.803</td>
<td>.138</td>
</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>8</td>
<td>1.97825</td>
<td>.481770</td>
<td>.1432</td>
<td>.272</td>
</tr>
<tr>
<td></td>
<td>2 weeks post insertion</td>
<td>8</td>
<td>2.64638</td>
<td>1.252329</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>Without dentures</td>
<td>8</td>
<td>2.17063</td>
<td>.388424</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Immediately after</td>
<td>8</td>
<td>2.69013</td>
<td>899058</td>
<td>1.432</td>
<td>.272</td>
</tr>
<tr>
<td></td>
<td>2 weeks post insertion</td>
<td>8</td>
<td>2.81963</td>
<td>.726266</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The mean speaking rate of females immediately after denture insertion decreased as compared to without denture, but was observed to be better after two weeks of adaptation. However, the speaking rate among the males was observed to better as compared to without dentures, and even more better after adaptation.

Table 2: Comparison of speaking rate between males and females of control group

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>Std deviation</th>
<th>t-value</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Females</td>
<td>10</td>
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<td>.320090</td>
<td>.653</td>
<td>.522</td>
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<tr>
<td>Males</td>
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<td>3.05960</td>
<td>.518115</td>
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</table>

Table 3: Comparison of speaking rate between participants and control group

<table>
<thead>
<tr>
<th>Gender</th>
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<th>Participants</th>
<th>N</th>
<th>Mean</th>
<th>Std.deviation</th>
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<th>P value</th>
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<tbody>
<tr>
<td>Female</td>
<td>Without dentures</td>
<td>Participants</td>
<td>8</td>
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<td>.467901</td>
<td>4.89</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
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<td>.320090</td>
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<td></td>
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<tr>
<td></td>
<td>Immediately after</td>
<td>Participants</td>
<td>8</td>
<td>1.97825</td>
<td>.481770</td>
<td>5.05</td>
<td>.000</td>
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<tr>
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<td>Controls</td>
<td>10</td>
<td></td>
<td>2.93390</td>
<td>.320090</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 weeks post insertion</td>
<td>Participants</td>
<td>8</td>
<td>2.64638</td>
<td>1.252329</td>
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<tr>
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<td>2.93390</td>
<td>.320090</td>
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</table>
Conted…

<table>
<thead>
<tr>
<th></th>
<th>Participants</th>
<th>Controls</th>
<th>Speaking Rate (per sec)</th>
<th>p-value</th>
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</thead>
<tbody>
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<td>10</td>
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<td>objective</td>
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The mean speaking rate of females without dentures was significantly less as compared to control group. Immediately after denture insertion, it was less compared to control group and was statistically significant (p<0.05). After 2 weeks post insertion, the speaking rate for female participants increased but less than control. For males the speaking rate without dentures was less than controls and was statistically significant (p<0.05). The speaking rate increased immediately after denture insertion and 2 weeks post insertion. The speaking rate after adaptation period of 2 weeks was still lower than control group. The combined speaking rate of participants without dentures and immediately after denture was significantly lower than control group. The combined speaking rate of participants after 2 weeks of adaptation period increased but was lower as compared to control group.

**Discussion**

Speech is an essential human activity, through which a speaker converts an idea in his mind into a stream of sounds, moving his lips, tongue and jaws in swift, precise gestures. Aging along with other body functions can adversely affect the speech. This is mainly due to loss of teeth and supporting structures, which alter the main articulatory cavity and produces marked effect on speech.

Removable complete denture prosthesis can partly solve the problem of impaired speech. However, they themselves can disturb speech production as they restrict the flexibility of tongue, narrow the oral cavity and alter the articulation areas of palate and teeth. The quality of speech production significantly affects participants’ general satisfaction with dentures and participant’s contentment in turn correlates with acceptance of dentures. Therefore speech production quality is an essential criterion for success or failure of complete denture rehabilitation.

The mean speaking rate was higher for males than females in both dentulous and edentulous individuals. This finding was in agreement with various studies which show gender differences with regard to speaking rate. Based on sociophonetic concept, it is possible that durational differences are associated with females speaking more clearly. This phenomenon could be related to physiological differences between males and females. It was also opined that males may have to travel greater articulatory distances than females to reach analogous phonetic targets. Therefore differences in articulatory speed is required in order to achieve similar perceptual products in males and females, making males move faster and females move slower. Gender related differences in a northern British accent showed lower rates of syllables per second for females, realizing consonant clusters more fully.

Also, sentence durations were longer for females than for males and males tend to elide or reduce vowels and consonants, which leads to shorter sentence durations. Females tend to read at a slower rate compared to males and females displayed greater variability in their sentence duration. In American English, it was observed that gender had a significant effect on speaking rate (measured for two sentences) and that females spoke more slowly than males. The speech rate studied in pluricentric language concluded that on average, males speak 6% faster than females. In line with these observations even in the present study the speaking rate of females was 4% lesser than that of males in control group.

The results also showed significantly lower speaking rate for both males and females without dentures when compared to control group. As there is limited literature on effects of complete or partial tooth loss on speaking rate, this finding can be explained on the basis of various structural changes that occur in articulatory cavity and associated structures after tooth loss. It was also reported that the duration required for the production of/s/sound was more in participants wearing conventional complete dentures than those wearing overdenture prosthesis. Thus it is possible that the natural tooth proprioception is required for maintaining an adequate speaking rate.
Normal function of tongue is important in maintaining adequate speaking rate as tongue is the main dynamic articulator which directs the flow of air during speech. [23] It is observed that tongue makes compensatory changes in the absence of teeth. [23] The absence of natural teeth can cause increase in tongue size and decreased tone of tongue. [24] Both these changes can adversely affect speaking rate, and so edentulous subject may take longer duration for phoneme articulation due to inadequate pressure generated by flaccid tongue. The weakening of perioral musculature after tooth loss would also result in inadequate intraoral pressure during articulation, further contributing to the problem.

The decrease in mandibular height, due to residual ridge resorption in edentulous participants, further alters the shape and size of oral cavity. The possible explanation of mandibular resorption causing decrease in speaking rate could be that it can affect the capability of tongue to make correct articulatory contacts. These changes may cause slower oral motor activity and prolonged phoneme.

After complete denture rehabilitation, the speaking rate for female decreased as compared to that without denture, and for the male participants the speaking rate increased immediately after denture insertion, compared to that without dentures. This can be understood on the basis of various studies showing gender related differences in denture satisfaction. [26] It was stated that males could adapt more easily to new removable dentures than females. Also females were found to be more concerned about esthetics and appearance than males, the lower speaking rate in females immediately after denture insertion may be a strategy to avoid embarrassment, related to fear that other people would recognize that they have dentures. [26] Male elderly females are at a higher risk of severe resorption in the edentulous mandible than males. The females reducing speaking rate immediately after denture may also be related to the low stability of mandibular conventional denture. It is more likely that complete dentures will move or even come out of the mouth during functions like eating and speaking. [27] Lower ability of females to adapt to new dentures and lower esthetic concern of males was also reported and could be considered as contributing factor for the difference between males and females. [28][29]

Speaking rate of males and females immediately after denture insertion was significantly lower than control. The possible causes of speech problem immediately after denture insertion could be related to unfamiliarity with new denture. [30] The new prosthesis may feel bulky and strange in mouth, along with this excessive salivation following new dentures can cause subject discomfort and slower speaking rate. Insertion of prosthesis can change phonation, articulation as well as resonance in the oral cavity, as it covers the palate and reduces the space for tongue movement. [31] Such deficiencies can lead to reduced speaking rate immediately after denture insertion. The results also showed that 2 weeks post insertion, the speaking rate increased both in males and females as compared to that without dentures, but was lower than control. It could also be owing to participants’ adaptation to new prosthesis over time. The speaking rate in participants without denture and immediately after denture insertion turned out to be significantly lower than control group. The speaking rate increased after adaption period of two weeks but never reached the normal. From the above findings we can interpret that an adaptation period has a significant value in improving the speaking rate. The limitations of this study could be attributed to minimal sample size and shorter adaptation period. Further study on influence of longer habitation period on speaking rate is warranted.

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ABSTRACT

There is a growing concern among researchers and practitioners on improving occupational health and safety in construction industry. Organizations are encouraged to improve safety culture because it plays a significant role in preventing accidents occurring at workplace. However, a diversity in topics of safety culture studies related to construction industry makes it hard to have a clear and comprehensive overview in this field. In this regard, a comprehensive review of literature is undertaken to provide an overview of trends and issues in safety culture research of construction industry. Further, a systematic literature review of available academic literature on safety culture is conducted focusing on: defining the concept of safety culture, identifying the factors influencing the level of safety culture and assessment tools to measure the level of safety culture in construction industry. Finally, a theoretical framework is proposed on the basis of conceptualizing the factors that affect safety culture in construction industry. This review helps in formulation and advancement of safety culture research in construction industry.

Keywords: safety culture; occupational health and safety; construction industry; systematic literature review

Introduction

The nature of construction industry is distinctive compared to other industries. Most construction activities take place outside under uncertain situations which is unfavourable for health and safety. Construction workers at jobsites are compelled to face continuous modification in the nature and situation of workers making it challenging to work. Recent statistics show that the level of working accidents (injury and illness rate) is 32% in the construction industry⁴, which is highest compared to other industries. Key cause of accidents and incidents in construction industry is a result of poor safety culture⁵ and to create a safe working condition, assessing and improving occupational health and safety culture is a necessity⁶. Therefore, there is a necessity for serious paradigm change in approach to occupational health and safety in construction industry⁷.

While, studies have been done on working safety culture in manufacturing industry⁸, it has been less investigated in construction industry⁹. Recent studies in construction industry have focused on measuring, sustaining and improving safety culture⁴,⁶,⁷. Assessing safety culture is reflected as a proactive method of safety performance⁸,⁹. Hence, most construction projects aim to minimize injuries and strive to achieve zero incidents, which can only be reached by thriving towards a positive safety culture within the construction industry⁴. Also, frequency of occurrence and severity of the nature of most accidents at construction sites makes it imperative to understand safety culture in the industry.

However, there exists diversity in topics of safety culture studies related to construction industry which makes it challenging to have a clear and comprehensive overview in this field. In addressing this knowledge gap, the aim of this paper is to deliver a comprehensive review of articles in terms of recent trends and issues in understanding and promoting safety culture of construction industry.
Issues Addressing Safety Culture in Organizations:
Predominant issues in literature on addressing safety culture in construction industry are: Transience of the industry, Subcontracting of work, Work organization, and Induction/acculturation process. These major issues shape the conception of safety culture as quite complex. The concept is challenging content-wise, and is multi-dimensional and cross-disciplinary study area. The conception on safety culture began in reaction to Chernobyl disaster and with time it spread to other industries. The notion of improving safety culture at workplace acts as a accident prevention system. This has led to constant growth in number of articles on this topic, thus making it challenging to attain a detailed overview on this topic.

Recent Trends in Safety Culture Studies: Number of scientific articles is an essential indicator to quantify the trend in a particular research area or field. In this regard, a comprehensive literature search was carried out to analyse recent trend in safety culture studies. Articles were collected from web-based search conducted on Scopus database by keywords search for the terms ‘safety culture’ and ‘construction industry’ in ‘title’, ‘abstract’ and ‘keywords’ of articles. This search yielded 140 articles and the data on these articles were further coded to analyse the trend in safety culture studies. As a result, 51 relevant articles were scrutinised that have direct relevance of the search terms relevant to construction industry.

In the last two decades, safety culture research has been extensively investigated and publication outcomes on the subject are growing ever since (Figure 1). However, the development maturity point has already been reached in this particular area or field with lack of consensus on its features and on the concept of safety culture. Careful examination on cumulative number of articles over the years indicates that the importance of the topic has increased tremendously and has become an important part of construction management research.

The distribution of articles by country/region are analysed and the articles are categorised based on the place in which the study was conducted, rather than merely the place of the authors. China has contributed with most articles (n = 10), followed by USA and Australia (n = 9), Hong Kong (n = 8) and India (n = 4). In these countries, there has been an increase in articles due to pressing concern towards safety management in construction industry.

Systematic Literature Review of Safety Culture Research in Construction Industry: Systematic literature review is a method for recognizing, choosing, and assessing all the literature upon an established level of measurable quality that is suitable to a research problem. This type of review style is more balanced and consistent in terms of transparency and objective specific. Hence, a systematic literature review of safety culture articles is conducted in this study.

Systematic literature review limits its focus on construction industry. However, some of the essential papers that focus on safety culture studies were included because of limited theoretical studies in the specific context of construction industry. These studies serve as a new perspective for exploring the commonalities among multiple industries that can be applied to construction industry. Previous systematic literature review in this area is limited towards proper identification of research area and knowledge structure. Together, these are considered subjective as they are generally determined from author’s decision. The following section is structured by as a systematic literature review methodology that outlines the concept of safety culture that includes defining safety culture, determining the most common safety culture factors, and measurement tools for assessing safety culture.

Defining Safety Culture: The term safety culture was recognised soon after the Chernobyl accident. However, no exact explanation of the term was provided for two main reasons: (i) several researchers highlight numerous safety culture elements as most significant, and (ii) culture of any kind is a tough thought to compactly outline. Most safety culture definitions are analogous in their beliefs and perceptions with each of them focused to varying degrees in relation to safety. Even though the definitions differ from one another, yet there is common agreement that safety culture is regarded as a proactive approach towards safety management. However, the
concept of defining safety culture in construction industry truly reflects the concept explained in other disciplines. The definition proposed by Fang and Wu (17) which is an attempt in defining safety culture at construction project level seems to be more practical, as it clearly outlines the concept of safety culture in construction industry.

Factors Affecting Safety Culture: A detailed analysis of factors that signifies a clear association existing among safety culture concepts and highlight the fundamental areas of safety management research is necessary for safety culture research (25). But it is challenging to comprehend underlying interactions existing between the antecedents and consequences of safety culture research as these influencing factors are not consistent and are fragmented. Also, there exists little agreement on safety culture factors that suggests multiple features and complexity of the concept.

Most safety culture models address three dimensions to define this concept. Various factors that affect safety culture are categorized under these dimensions:

1. Personal Factors: These comprise psychological aspects of individual’s and group values, attitude and perception towards safety and describe “how people feel within an organization’s safety management system?” and are evaluated through safety questionnaires. Factors include: co-worker’s commitment, worker involvement, worker competence and control, attitudes, trust among employees, sub-contractor involvement, and safety incentives and disincentives.

2. Behavioural Factors: This deals with actual ongoing safety-related actions and behaviours and describes “what people do within an organizations safety management system?” and are evaluated through safety checklists. Factors include: supervisor’s commitment, risk management, safe work conduct and safety practices.

3. Situational Factors: This encompasses situational features that include policies, procedures, regulations, organization structure and the management system. It describes “what the organisation has or has to put in place?” and are evaluated through safety audits and inspections. Factors include: safety policies, resources and training, management commitment, organizational commitment, communication and top management safety response.

Above factors greatly influence the level of safety culture in an organization. Hence, more focus has to be given to these influencing factors for achieving a positive safety culture at workplace.

Safety Culture Measuring Instruments: Proper identification of measuring instrument is essential to assess safety culture in respective organizations. In real time application, one needs an effective measurement tool to measure the level of safety culture. The level of safety culture in different sectors is typically assessed through quantitative questionnaires which are based upon any number and combination of the factors as mentioned in previous section. Among numerous measurement tools developed, Safety Climate Assessment Tool (S-CAT) is an assessment tool that is holistic in nature and is specifically designed for construction industry. This tool is developed based on recommendations and inputs provided from multiple stakeholders in construction projects and can be utilized by contractors to improve safety culture at their jobsites.

Discussion

Despite continuous improvements on safety management studies in construction industry over the years, safety related issues are still in existence. Some of the cultural issues that are identified from various literature are highlighted in this review. These issues mainly address safety culture in an organization and needs utmost attention for facilitating positive safety culture formation to reduce accidents, hazards and risks in the working level of the industry. Also, in addressing these adverse effects or issues, organizations need to encourage safety culture practices for creating a positive working environment within the organization.

Based on systematic literature review of construction safety culture articles, a theoretical framework is formulated on its influencing factors (See section - Factors affecting safety culture). These factors exhibit interaction effect similar to Cooper’s model of safety culture (25). The model explains three basic dimension that influences safety culture in terms of triadic reciprocal actions, wherein personal, behavioural and situational factors has an impact on each other bi-directionally (26). Bandura (26) states that the reciprocal actions do not occur simultaneously nor its influence has an equal effect but it takes sufficient time for underlying factors to make an influence on the
dimensions. For example, the bi-directional influence of an individual is affected by workplace safety practices and policies, resources and safety training employed by the organization. This interaction model is a perfect framework to investigate safety culture for various reasons. Firstly, this interactive association explains accident causation relationship between safety culture factors at various levels of the industry\(^{27,28}\). Secondly, measurement of factors in each of the dimension reflects the bi-directional dynamic interaction by providing a “triangulation methodology”\(^{29}\) that reflect on the overall safety culture\(^{30}\). Lastly, it integrates goal-setting tasks by self-regulatory processes, sub-goals and development strategies within an organization\(^{28}\). The model outcomes aids in exploring the concept in terms of formulation and advancement towards building a positive safety culture in construction industry.

Systematic literature review adopted in this study limits its focus on construction industry and this can be further explored by conducting a deeper content analysis on articles of safety culture researches.

Conclusions

Many organizations, including construction industry have shown greater attention towards facilitating safety culture as a means to decrease accidents, incidents and risks occurring at the workplace. For effective implementation of safety management, organizations tend to set safety culture as a significant factor for enhancing occupational health and safety at workplace. This creates the potential to explore the recent trends in safety culture research. But, the amount of literature available on this topic makes it challenging for practitioners and researchers to have a structured outline of the topic. So, this study makes an attempt to provide essential concepts of safety culture research in construction industry by providing suitable realistic evidence and theoretical developments.

The sole purpose of the review is to know how researchers have defined and measured safety culture to predict and justify health and safety outcomes in construction industry. The information provided in this study gives a clear representation on the topic of safety culture as this can help researchers and practitioners for recognizing critical influences from articles of safety culture research topics. Also, this paper provides insights on various constructs of safety culture studies till date and makes an attempt to explain the present trends and issues towards creating a safe operational environment in construction industry. Finally, this review is believed to encourage further research on safety management aspects in construction industry.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Not Applicable

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Diet and Physical Activity Levels among Obese Homemakers in Urban Udupi—A Cross Sectional Study

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ABSTRACT

Study Background: Obesity is the most prevalent nutritional disorders in developed and in developing countries, especially in India due to urbanization. According to NFHS-4 in 2015-16, in Karnataka state, 31.8% of urban women were obese. Women who are obese in Udupi district as per NFHS-4 (2015-16) is 20.7%. As per WHO (2015), the major reason for overweight and obesity is due to an imbalance in caloric intake and consumed. Obesity management therefore commonly involves diet and increased physical activity. An estimate of current levels of diet intake and physical activity is required for appropriate planning of intervention for obesity.

Objectives: To estimate the physical activity levels and diet levels of obese Homemakers in urban Udupi.

Method: A cross-sectional study was carried out among obese homemakers residing in urban Udupi. A total of 180 obese homemakers were recruited from 30 wards based on BMI criteria at the age group of 30 to 45 years. The physical activity levels were measured in MET values using Global Physical Activity Questionnaire and MET-Minutes per week using a physical activity diary. The diet intake was measured for one week using caloric intake using a diet diary.

Results: The mean age of study population was 36.77 years with a standard deviation (SD) of ± 5.089. The mean caloric intake of the study participants were 2076 ± 253.26. One sample ‘t’ test was used to compare the mean caloric intake of participants with the mean standard caloric intake of 1800 calories per day which shows statistically significant difference with p<0.001. The mean physical activity of the study participants were 425 ± 84.05 MET per week. One sample ‘t’ test was used to compare the mean physical levels of participants with the standard physical activity requirements as per WHO i.e.600MET-minutes per week which shows statistically significant differences with p<0.001.

Keywords: Obesity, Physical Activity, Diet, Homemakers

Introduction

Obesity is the most prevalent nutritional disorders in developed and in developing countries, especially in India due to urbanization. It is turning out to be most common health issue worldwide in the majority of the population, affecting youths, adults and specially Housewives or women1. According to NFHS-4 in 2015-16, in Karnataka state, 31.8% of urban women were obese or overweight. Women who are overweight/obese in Udupi district as per NFHS-4 (2015-16) is 20.7%. As per WHO (2015), the major reason for overweight and obesity is due to an imbalance in caloric intake and consumed. All over world, there has been an increment
in physical inactivity and higher intake of energy rich foods, especially fat\textsuperscript{3}. Obesity management therefore commonly involves proper diet and increased physical activity. An estimate of current levels of diet intake and physical activity is required for appropriate planning of intervention for obesity.

**Objective**

To estimate the diet and physical activity levels of obese homemakers in urban udupi.

**Method**

**Study Design and Setting:** This cross sectional study was carried out during August 2017 in Udupi district, southern Karnataka after obtaining ethical clearance from Institute Research Committee (IEC 222/2016) Manipal. In this study, the unit of allocation is based on “wards”. The entire urban Udupi area consists of 35 wards. In that, 30 wards was selected. For each ward, 06 subjects were selected based on selection criteria. A total of 180 obese homemakers were recruited from 30 wards in urban udupi community based on BMI criteria for Asians as per WHO (25 \( \text{–} 34.9 \)) within the age group of 30 to 45 years. The exclusion criteria included women who are pregnant or in plan to get pregnant, history of any eating disorders, physical/cognitive disabilities, unstable medical or psychiatric conditions, Diabetes Mellitus, Hypertension, thyroid disorder and family history of obesity. In the community, Homemakers as per the selection criteria were identified through Door-to-Door survey method.

**Screening Tools:** In order to select the participants, screening tests such as Physical Activity Readiness Questionnaire to assess physical status, General Health Questionnaire to exclude psychiatric illness and Random Glucose Test to screen for Diabetes Mellitus, Blood Pressure measurement for hyper/hypotension and TSH test to screen for thyroid disorder were carried out to each participant.

**Data Collection:** The physical activity levels of participants were measured using Global Physical Activity Questionnaire (GPAQ) developed by WHO. It evaluates total volume of moderate and vigorous intensity physical activity behaviour in three domains such as work, transport and leisure for a typical week. Moderate intensity activities are the activities involving moderate physical effect causing a small increase in breath or heart rate whereas vigorous intensity activities requires hard physical effect casing large increase in breathing or heart rate. According to WHO, a participant is termed as physical active if they involve in 150 minutes of moderate intensity physical activity or 75 minutes of vigorous intensity physical activity or an equivalent combination of moderate and vigorous activities of total atleast 600 MET- minutes per week with each activity bout of minimum 10 minutes duration\textsuperscript{4}. In addition to GPAQ, a physical activity diary was also used to measure the various physical activities carried out by participants prospectively for a typical week. The diet intake was measured for one week using caloric intake (food) using a prospective diet diary in order to avoid recall bias. Participants were trained to record the food intake (food item and quantity) and physical activity (actual activity and duration) they performed in diet and physical activity diary prospectively provided by the investigator. Gathered data was entered and analysed in SPSS version 15

**RESULTS**

**General Characteristics of Participants:** A total of 180 obese homemakers were recruited for the study. The mean age of study population was 36.77 years with a standard deviation (SD) of \( \pm 5.089 \) (range 30–45 years). 78.9\% (142) participants were in obese grade I and 21.1\% (38) were in obese grade II as per WHO classification for Asians. Among them, 65\% (117) belonged to nuclear family. In educational status, only 12.3\% (22) were graduates. 21.1\% of participants belonged to upper class, 59.4\% were upper middle, 13.9\% lower middle and 5.6\% of participants belonged to upper lower class. About 83.9\% (151) were non-vegetarians.

**Diet Intake:** The mean caloric intake of the study participants were 2076 \( \pm 253.26 \) (minimum: 1303 and maximum: 2722). One sample ‘t’ test was used to compare the mean caloric intake of participants with the mean standard caloric intake of 1800 calories per day. Statistically significant difference was found with \( p < 0.001 \) which revealed that the mean caloric intake of the study participants was higher.

**Physical Activity Levels:** The mean physical activity of the study participants were 425 \( \pm 84.05 \) (minimum: maximum) MET per week. 95 percentage of study participants were physically inactive. One sample
‘t’ test was used to compare the mean physical levels of participants with the standard physical activity requirements as per WHO i.e.600MET-minutes per week. Statistically significant differences was found with p<0.001 which revealed that the mean physical activity levels of the study participants was lower indicative of ‘physically inactive’

Discussion

Overall a high proportion of participants were consuming a high amount of calories daily in this study. This may be due to increase in purchase power and accessibility to energy dense, high fat food items\(^5\). In this study, the participants were obese homemakers belonging to urban area. Research also supports that nutrition transition occurring in India is fueling the chronic diseases and obesity especially in urban areas\(^6\). Dietary patterns in India were appeared positively associated with obesity\(^7\). In physical activity assessment majority of participants were physically inactive. 95 percentage of participants were physically inactive i.e. less than the minimum duration recommended by WHO. This was supported by a study carried out by Anjana et.al in 2014 which revealed that a high proportion of individuals were physically inactive, more common in urban than rural, also men stood considerably more active when compared to women. Major time spends in moderate level to vigorous level - intensity activity happens in the workplace\(^8\). Since our participants were homemakers, they have limited opportunity to involve in physical activity related to work. In this study, majority of participant’s diet intake (calories) was higher than normal daily requirements and they also had lower level of physical activity which would lead them to obese category.

Conclusion

Overall women who are homemakers by occupation in urban udupi community areas had poor dietary practices and low levels of physical activity which is the main reason for their obesity. As obesity is associated with many health hazards, it is important to initiate a community level health intervention programs suitable specifically to the target population in community.

Conflicts of interest: Nil

Source of funding: Self

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Aerobic Capacity in Obese School going Children Between 11 and 14 Years of Age: A Cross Sectional Study

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ABSTRACT

Background: Childhood obesity is an epidemic. Obesity is associated with aerobic capacity. Childhood obesity leads to decreased aerobic capacity that leads to cardiovascular diseases in the adulthood. Maximal oxygen consumption (VO₂ max) also known as aerobic capacity or aerobic fitness indicates the physical fitness of a person.

Objective: The objective of the study is to determine the relationship between obesity and aerobic capacity in school children aged 11 to 14 years.

Materials and Method: 100 school children between 11 and 14 years from the schools in Thiruvananthapuram city were included in the study using simple random sampling method. Students with musculoskeletal impairments, cardio respiratory disorders, neurological impairments, general weakness, smokers and alcoholics were excluded from the study. BMI percentile has been calculated for all the students. They were divided into three BMI categories. i.e., Normal weight, Overweight and Obese. Multistage 20 meter shuttle run test was conducted on all the subjects to determine the VO₂ Max. The pearson correlation for the VO₂ Max was -.905, P value was .000 which shows that there is a significant correlation at 0.01 level between BMI categories and VO₂ Max. Also the value shows that the correlation is negative, i.e., as the BMI percentile increases the VO₂ Max decreases and vice versa.

Conclusion: The result of the study shows that there is a significant negative correlation between the BMI percentile and the VO₂ max in school children aged between 11 years and 14 years. Hence as the BMI percentile increases the VO₂ max decreases and vice versa in school children. Thus the study concludes that obese school going children are having less aerobic capacity.

Keywords: Aerobic Capacity, VO₂ Max, Childhood Obesity, Body Mass Index

Introduction

Obesity is defined as “abnormal or excessive fat accumulation that presents a risk to health”. Childhood obesity is becoming an epidemic ¹. Researches found that the body composition is affected by the changes in nutrition which includes the increased consumption of refined and processed foods, decreased physical activity which is the consequence of the urbanization and digitalization. ²,³,⁴,⁵. Apart from the increase in the childhood obesity and passive lifestyle, changes in the children’s physical fitness is a strong marker of the chronic disease risk. ⁶,⁷. Tomkinson and colleagues found that there was an annual decline of 0.36% in the aerobic fitness of 6–19-year-olds from five geographical regions i.e., Africa, Middle and East Asia, Australia, Europe, and North America ⁸. Obesity is one among the chronic lifestyle disorders especially cardiovascular and respiratory diseases ⁹,¹⁰. Physical fitness in children has been found to be associated with better health outcomes in terms of blood pressure, muscle strength, blood lipids, serum insulin or blood vasculature characteristics ¹¹,¹²,¹³.
Cardio-respiratory capacity of a person shall be assessed by maximal oxygen consumption (VO₂ max) also known as aerobic capacity or aerobic fitness and indicates the physical fitness of a person. Aerobic fitness is the ability of the body to distribute oxygen to the muscles, which is responsible for the physical activity. The lungs receive the oxygen from the air and this oxygen is carried into the blood stream; the heart and blood vessels deliver the oxygen to the skeletal muscles which executes the muscular contractions. VO₂ max is the maximum ability of the body to transport oxygen from the air to the muscles for the production of energy. It is the ability of the heart to pump oxygen-rich blood to the muscles, as well as the efficiency of the muscles in extracting and utilizing the oxygen. VO2 max is measured in milliliters of oxygen per kilogram of body weight per minute of exercise (ml/kg/min). As intensity of the exercise increases the oxygen consumption also increases. However, when a point is reached, the intensity of exercises increases without concurrent increase in oxygen consumption. This point at which oxygen consumption plateaus is the VO2 max or an individual’s maximal aerobic capacity. Max VO₂ is the best indicator of cardiorespiratory endurance and aerobic fitness. Researches has documented that a low aerobic fitness level is associated with an increased risk of premature death especially because of cardiovascular disease. Hence, higher aerobic fitness levels are associated with various health benefits such as reduced risk of cardiovascular diseases, stroke, diabetes, etc. To improve or maintain cardiovascular health an individual must engage in aerobic exercises such as jogging, swimming, cycling, walking etc. with 60 minutes per day for a frequency of 3 days per week. Evaluating VO₂ max in obese individuals can help in early detection of cardiovascular impairments and help to plan appropriate intervention strategies. Among the various tests, Multistage 20 meter shuttle run test is the most popular indirect method that evaluate the VO₂ Max. The purpose of the present study is to determine the relationship between obesity and aerobic capacity in school children aged 11 to 14 years.

Materials and Method

100 school children between 11 and 14 years from the schools in thiruvananthapuram city were included in the study using simple random sampling method. Students with musculoskeletal impairments, cardio respiratory disorders, neurological impairments, general weakness, smokers and alcoholics were excluded from the study. BMI percentile has been calculated for all the students. They were divided into three BMI categories. i.e., Normal weight, Overweight and Obese. Multistage 20 meter shuttle run test was conducted on all the subjects. Each student being tested ran across the 20 meter distance and touch the line with a foot by the time the beep sounds. The initial speed of the shuttle run was 8.5 km/hr. The speed of the shuttle run got progressively increased at the rate of 0.5km/hr every minute, as dictated by the frequency of adjusted “beep” sound signal from a pre-recorded audio tape. The student should take the full weight on the foot while touching the line. At the sound of the beep, the student turns around and runs back to the other end. Students continue in this manner until they failed to reach the line before the beep for the second time. VO₂ Max was calculated by the equation proposed by Leger et al. The results were recorded and analyzed statistically.

Statistical Analysis

The result was analyzed using SPSS software version 24. The statistical tool used was pearson correlation.

Results

Figure 1: Age wise and Genderwise distribution of Boys & Girls in different BMI Categories

![Figure 1: Age wise and Genderwise distribution of Boys and Girls in different BMI categories.](image)

Figure 1 shows the Age wise & Genderwise distribution of the boys and girls in different BMI categories. Under 11 years of age 2 boys and 2 girls were under normal weight category, 6 boys and 4 girls were under over weight category and 3 boys and 2 girls were under obese category. Under 12 years of age 2 boys and 2 girls were under normal weight category, 7 boys and 4 girls were under over weight category and 3 boys and 3 girls were under obese category. Under 13 years of age 3
boys and 3 girls were under normal weight category, 7 boys and 5 girls were under over weight category and 4 boys and 7 girls were under obese category. Under 14 years of age 3 boys and 3 girls were under normal weight category, 7 boys and 7 girls were under over weight category and 3 boys and 8 girls were under obese category.

Table 1: VO\textsubscript{2} Max in different BMI categories

<table>
<thead>
<tr>
<th>BMI CATEGORIES</th>
<th>VO\textsubscript{2} Max</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight</td>
<td>59.1000</td>
<td>20</td>
<td></td>
<td>2.07491</td>
<td>55.00</td>
<td>64.00</td>
</tr>
<tr>
<td>Over weight</td>
<td>37.3191</td>
<td>47</td>
<td></td>
<td>1.49064</td>
<td>35.00</td>
<td>40.00</td>
</tr>
<tr>
<td>Obesity</td>
<td>32.3939</td>
<td>33</td>
<td></td>
<td>1.78430</td>
<td>30.00</td>
<td>36.00</td>
</tr>
<tr>
<td>Total</td>
<td>40.0500</td>
<td>100</td>
<td></td>
<td>9.96395</td>
<td>30.00</td>
<td>64.00</td>
</tr>
</tbody>
</table>

Table 1 shows the VO\textsubscript{2} Max for different BMI categories. In normal weight category, the mean VO\textsubscript{2} Max was 59.1, standard deviation was 2.07, minimum value was 55.0 and the maximum value was 64.0. In the overweight category, the mean VO\textsubscript{2} Max was 37.3, standard deviation was 1.4, minimum value was 35 and the maximum value was 40. In the obese category the mean value of VO\textsubscript{2} Max was 32.3, standard deviation was 1.7, minimum value was 30 and the maximum value was 36.

Table 2: Correlation between BMI categories and VO\textsubscript{2} Max

<table>
<thead>
<tr>
<th>BMI Percentile</th>
<th>VO\textsubscript{2} Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pearson Correlation</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2 shows the correlation between the BMI categories and VO\textsubscript{2} Max in school children between 11 year and 14 years old age. The Pearson correlation for the VO\textsubscript{2} Max was - .905, P value was .000 which shows that there is a significant correlation at 0.01 level between BMI categories and VO\textsubscript{2} Max. Also the value shows that the correlation is negative, i.e., as the BMI percentile increases the VO\textsubscript{2} Max decreases and vice versa.

**. Correlation is significant at the 0.01 level (2-tailed).

Discussion

100 school children between 11 and 14 years from the schools in thiruvananthapuram city were included in the study using simple random sampling method. BMI percentile has been calculated for all the students. They were divided into three BMI categories, i.e., Normal weight, Overweight and Obese. Multistage 20 meter shuttle run test was conducted on all the subjects. VO\textsubscript{2} Max was calculated by the equation proposed by Leger et al\textsuperscript{20,21}. The Pearson correlation for the VO\textsubscript{2} Max was -.905, P value was .000 which shows that there is a significant correlation at 0.01 level between BMI categories and VO\textsubscript{2} Max. Also the value shows that the correlation is negative, i.e., as the BMI percentile increases the VO\textsubscript{2} Max decreases and vice versa. Obesity is often associated with a wide range of cardio vascular abnormalities\textsuperscript{22}. The consequences of obesity are metabolic dysregulation with increased prevalence of atherogenic risk factors, including insulin resistance, hypertension, and dyslipidemia; adverse cardiac remodeling characterized by hypertrophy, chamber enlargement, and impaired ventricular systolic and diastolic function; vascular endothelial dysfunction; premature coronary artery disease; increased sympathetic tone; pulmonary hypertension with right-sided heart strain; and arrhythmias. Obesity leads to excessive amount of cholesterol in the blood. This increases the fat deposits in the walls of the coronary arteries which is known as atherosclerosis. Thus there is a narrowing of the coronary arteries that leads to coronary artery
disease. Heart function has an association with BMI as well as the duration of obesity. Obesity adversely affects the respiratory system causing abnormalities in the mechanics of the respiratory system. Obesity decreases the strength and endurance of the respiratory muscles, decreases the gas exchange and the exercise capacity. Impairment in the lung function is caused by the accumulation of the excessive adipose tissue in chest wall and the abdominal cavity, which may compress the thoracic cage, diaphragm, and lungs. This may limit diaphragm displacement and compliance of the lung and chest wall. This results in a decrease in lung volumes. The respiratory function severely worsens with an increase in the BMI of individual. Goran et al. found that VO$_2$ max is decreased in individuals with excessive body weight.

**Conclusion**

The result of the study shows that there is a significant negative correlation between the BMI percentile and the VO$_2$ max in school children aged between 11 years and 14 years. Hence as the BMI percentile increases the VO$_2$ max decreases and vice versa in school children. Thus the study concludes that obese school going children are having less aerobic capacity.

**Ethical Clearance:** Ethical clearance has been obtained from the Institutional Ethical Committee of Bethany Navajeevan College of Physiotherapy

**Source of Funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


Assessment of Barriers and Constraints Involved in Early Dog Bite Case Reporting and Management Under Integrated Disease Surveillance Programme (IDSP), Hassan (Karnataka)

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ABSTRACT

Background: Rabies is one of the endemic diseases in India with dog rabies being a major public health problem with more than 90% of mortality and morbidity. National Rabies Control Programme which was approved by the Government of India under 12th five-year plan aims to control the disease. Surveillance of dog bite cases is done by Integrated Disease Surveillance Programme which helps in detection of outbreaks quickly.

Objectives: This study was planned to assess the effectiveness in the early case identification of dog bite cases who are eligible to receive post exposure prophylaxis and to identify the barriers in the reporting of cases in Hassan peripheral health centres.

Method: The study was conducted during the period of May to October 2017 in Hassan district of Karnataka, India. Cross-sectional evaluation of dog bite case reporting along with retrospective record analysis of one-year dog bite cases in the selected health centres comparing with the data obtained from the IDSP portal of the District Surveillance Office.

Results: Significant under-reporting was noticed with respect to the number of cases registered in the health centre and the number of cases reported to IDSP. Staff nurses were trained for IDSP in only 58.3% of the centres. Significant correlation was found between reporting of data to IDSP portal and training received by the staff.

Conclusion: For improvement in the dog bite case detection and control of rabies in India, there is a need to improve the surveillance system. Manual reporting of dog bite cases through IDSP can be replaced by real time data reporting through IHIP to minimize errors.

Keywords: Rabies, Dog bite, Surveillance, Case reporting, Integrated Disease Surveillance Programme (IDSP), Integrated Health Information Platform (IHIP).

Introduction

Rabies is a zoonotic disease which is fatal but 100% preventable. Annually about 55,000-60,000 persons die of rabies worldwide. Out of which nearly one-third cases are from India. About 99% of these deaths are followed by bites/exposures to dogs.¹,² Rabies is identified as a priority disease for global and national level control measures.³

National Rabies Control Programme proposed by the National Centre for Disease Control (NCDC) was approved by the Government of India under 12th five-
year plan\textsuperscript{4,5}, and has received top priority under the recent government health agenda.

It is important for the disease to be declared as notifiable to establish functional reporting. There should be mechanisms for data transmission from the community level to the national and international level. This can provide feedback on the effectiveness of the programme. Further, the areas of weakness can be improved by taking appropriate actions.\textsuperscript{1} Monitoring and surveillance of the disease should be given priority.\textsuperscript{4,5}

In India, surveillance and reporting of dog bite cases is done under Integrated Disease Surveillance Programme (IDSP) which was launched in 2004.\textsuperscript{6,7} It is a decentralized state based surveillance programme, where the weekly surveillance data on certain diseases are being collected from various reporting units such as sub centres, primary health centres, community health centres, government and private hospitals, laboratories and medical colleges.\textsuperscript{8,9} The increase in number of cases even after more than a decade of implementation of IDSP indicates inadequacy of the surveillance system.\textsuperscript{10}

**Objectives**

The present study was planned to assess the effectiveness in the early case identification of dog bite cases who are eligible to receive post exposure prophylaxis and to identify the barriers in the reporting of cases in Hassan peripheral health centres.

**Materials and Method**

**Study Design:** Cross-sectional evaluation of dog bite case reporting along with retrospective record analysis of one-year dog bite cases in the selected health centres comparing with the data obtained from the IDSP portal of the District Surveillance office of Hassan district.

**Study Procedure and Data Collection:** This study was conducted in Hassan district of Karnataka, India during the period of May to October 2017. Hassan has 8 taluks which are scattered at a distance of 14.8km to 54km from our medical college. These are Alur (14.8km), Arkalgud (44.8km), Arsikere (44.2km), Belur (44.9km), Channarayapatna (38.4km), Hassan, Holenarsipura (45.1km) and Sakleshpur (54km). Each taluk has health centres ranging from a minimum of 6 centres in Alur to a maximum of 38 centres in Hassan.

After obtaining permission from the District Health Officer, IDSP data for one year i.e., from April 2016 to March 2017 of all the centres of 8 taluks was collected from the IDSP portal. Among various diseases included in IDSP, dog bite cases were selected considering the rise in number of dog-bite cases in the district\textsuperscript{11}, and one-year data on the dog bite cases of all the taluks was compiled. Three centres from each taluk, a total of 24 centres from the district, which reported maximum number of dog bite cases in that one year were listed.

All the 24 centres, which are at a distance of minimum 3km to maximum 90km from our medical college, were visited. Dog bite registers from the centres were reviewed, weekly data of dog bite cases was compared with the data of weekly P-forms obtained from the IDSP portal. Two informants per health facility, particularly staff nurse and lab technician were interviewed regarding their knowledge about registering the cases and reporting the cases to IDSP, regarding the training of health workers, entering the cases in the weekly P-form, and about reporting the data to higher centres. All the details were noted.

**Findings**

Study was conducted in 24 centres of 8 taluks of Hassan district. Results are compiled based on the availability of dog bite register in the centres, entering the cases in the weekly P-forms, reporting to higher centres and training of the health workers.

Dog bite registers were not maintained in proper format. In few centres, dog bite cases were entered in the OPD register. Weekly P-forms were filled by staff nurse in most of the centres, or by lab technician or Medical Officer in few centres. Most of the health workers were not trained in IDSP.

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Centre</th>
<th>Population covered</th>
<th>No. of Dog Bite Cases Reported to IDSP</th>
<th>Enter in Register</th>
<th>Dog Bite Register availability</th>
<th>Training of Staff Nurse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alur</td>
<td>K.Hosakote</td>
<td>7123</td>
<td>22</td>
<td>19</td>
<td>Absent</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Rayarakoppalu</td>
<td>9814</td>
<td>6</td>
<td>6</td>
<td>Absent</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>K.Channapura</td>
<td>5359</td>
<td>6</td>
<td>6</td>
<td>Absent</td>
<td>No</td>
</tr>
</tbody>
</table>
Table 1 conted…

<table>
<thead>
<tr>
<th></th>
<th>Konanur</th>
<th>706</th>
<th>701</th>
<th>Present</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkalgud</td>
<td>19104</td>
<td></td>
<td></td>
<td>Present</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>10906</td>
<td>4</td>
<td>6</td>
<td>Present</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>14491</td>
<td>2</td>
<td>0</td>
<td>Absent</td>
<td>Yes</td>
</tr>
</tbody>
</table>

|                  | Gandasi   | 19869 | 123 | 132 | Present | Yes |
| Arsikere         | Banavara  | 35879 | 67  | 59  | Present | Yes |
|                  | JC Pura   | 5713  | 63  | 0   | Absent  | Yes |

|                  | Halebeedu | 10600 | 290 | 375 | Present | No  |
| Belur            | Hagare    | 30543 | 44  | 44  | Present | Yes |
|                  | Arehally  | 20466 | 36  | 38  | Present | Yes |

|                  | Hirisave  | 12070 | 422 | 383 | Present | No  |
| Channarayapatna  | Udayapura | 18998 | 59  | 59  | Present | Yes |
|                  | Karehally | 9378  | 40  | 0   | Absent  | No  |

|                  | Shantigrama | 13259 | 98  | 121 | Present | Yes |
| Hassan           | Mosalehosahalli | 4068  | 111 | 124 | Present | No  |
|                  | Krishna Hospital | 48527 | 39  | 39  | Present | Yes |

|                  | Paduvalahippe | 14331 | 17  | 17  | Absent | No  |
| Holenarsipura    | Doddakadanur | 13744 | 50  | 67  | Present | Yes |
|                  | Hally Mysore  | 11375 | 19  | 0   | Absent | No  |

|                  | Yasalur | 5254  | 23  | 0   | Absent | No  |
| Sakleshpur       | Vanagooru | 5564  | 13  | 0   | Absent | Yes |
|                  | Devaladakere | 3264  | 17  | 0   | Absent | Yes |

*Dog bite cases were entered in the dog bite register in those centres where separate dog bite register was available; and in OPD register where separate dog bite register was not available.

Table 1 shows the profile of number of dog bite cases registered, number of cases reported to IDSP, availability of dog bite register and training of staff nurse for IDSP in all the 24 centres.

Dog bite registers were not maintained uniformly. Staff nurses from all the 3 centres of Arkalgud and Arsikere taluks were trained for IDSP, dog bite registers were available in 2 out of 3 centres in both the taluks, but differences were seen in the number of cases registered and reported. One centre each from Arkalgud and Arsikere taluks had no dog bite register and the cases were not entered in OPD register, but were reported to IDSP as a routine.

All the 3 centres of Belur taluk had dog bite registers, staff nurses from 2 centres were trained for IDSP where there was better reporting. Staff nurse in Halebeedu centre of Belur was not trained for IDSP, and there was significant difference in the reporting. Staff nurse of only Udayapura centre from Channarayapatna taluk was trained for IDSP, where there was proper reporting of the cases. In Hassan, Holenarsipura and Sakleshpur taluks, there is no proper alignment in reporting and training obtained by staff in the entire process of surveillance of dog bite cases.

Out of 24 centres included in the study, significant under-reporting was noticed in 13 centres with respect to the number of cases registered in the centre and the number of cases reported to IDSP. Overall, it was found that the reporting of dog bite cases was not accurate in most of the centres.

**Statistical Analyses**

To find correlation between reporting of data to IDSP portal and based on training received on mode of timely and accurate submission of report, mean value of reporting was 94.88 (SD 162.13) and Pearson correlation 0.98 which was found to be having strong correlation. Similarly, in regard to maintenance of dog bite registers, correlation was highly significant (r=0.98 and p<0.001). Further analysis was attempted considering two groups
as two independent samples i.e., data reporting to IDSP and presence of dog bite registers in the health centres where ever dog bite case management was done. For the same, Independent sample t test was applied where Levene’s test for equality of variances (population vs sample comparison) found highly statistical significant (p<0.003) and t value=2.232 (95% CI 9.704-264.072). We also checked for its sensitivity (76.9%) and specificity (63.6%). In contrast, when training aspect was subjected to independent t test, t test statistic value is not significant (p=0.985). Further regarding cross-verification between availability of dog bite registers and type of entry made pertaining to cases reported, it was highly significant (F=13.18, P<0.001) (t=2.63, p<0.015, 95% CI 34.31-287.42). But same relation with regard to training impact on entry in registers were not found. In addition, considering limitation of sample size and to capture actual facts, bootstrapping was done on given data where 1000 sample iteration result yields with a mean value=165.23 and BCa 95%CI 69.27-282.47. To make comparison between groups and within groups such as reporting to IDSP and training part per se using one-way ANOVA, it is not statistically significant (p=0.98); in comparison to dog bite register availability and prompt reporting to IDSP portal, it is significant statistically (F=4.98, p<0.036). The above analyses were done using SPSS software version 22.0.

**Fig. 1: Training of Staff Nurses**

Staff Nurse present in each centre at the time of visit was interviewed regarding IDSP functioning and their training. It was found that the staff nurses were trained for IDSP in only 14(58.3%) centres and they received the training only once.

**Discussion**

A significant reduction in human rabies has been achieved in Mexico, South America and the Caribbean during the last two decades. More than fifty countries are currently free of rabies.13 But rabies is predominant in the developing countries with increase in cases over the past two decades in parts of sub-Saharan Africa and Asia, because of rapidly growing dog populations and increasing urbanization.13 Surveillance should be given importance for effective control of rabies, and focus should be on effective reporting of dog bite and rabies cases.

The present study showed that the reporting of dog bite cases was not accurate in 33.3% of the centres and registers were found incomplete. Dog bite cases were not registered in 6 centres but sent to IDSP, which explains poor surveillance. The findings are supported by studies conducted in Ghana which showed poor surveillance.14,15

The weekly P-forms of IDSP which are to be filled by Medical officers were mostly filled by staff nurses in those centres. Only 58.3% of those staff nurses were trained once for IDSP. Training of the health workers and reporting the data to IDSP portal was found to be having strong correlation. Similar findings were found in a study conducted in West Bengal by Integrated Disease Surveillance Project (IDSP) units which showed that the reporting status improved year by year after training of health workers.16

The present study also found lack of supervision of the reporting system contributing to fallacies in the system. In a study by Adokiya M et al., it was shown that supervision was largely absent and disease surveillance activities were of low priority for nurses, doctors, administrators and laboratory workers.15

An Integrated Health Information Platform (IHIP) is being setup by the Ministry of Health and Family Welfare, Government of India, for comprehensive Health Information Exchange (HIE) through Electronic Health Records (EHRs) of the citizens.17 This electronic information system aims for real time data reporting with the help of mobile application accessible at all levels.18 Manual reporting errors can be minimised with the help of this real time data reporting.

A study conducted by Diwan V et al. in Madhya Pradesh showed that software related issues such as duplicate data entry was monitored regularly with the data entered in electronic form.19 Another study by Adokiya M et al. in northern Ghana showed that mobile phone reporting made IDSR report submission easier.15

**Conclusion**

India is among those countries with highest number of rabies cases. We found that there was inaccurate
reporting of cases from the health centres through IDSP, which conceal the actual magnitude of dog bite cases. We also found that the health workers were not sufficiently trained leading to improper maintenance and entry of cases in the registers, thereby improper reporting and surveillance. So improvement in surveillance is imperative through intensive training of the health workers, regular monitoring and supervision and concurrent review of the system. Manual weekly reporting from the health centres to the higher centres by untrained and incompetent staff through IDSP may cause errors. To overcome this deficiency, IHIP which aims for the real time data reporting can be more effective in improving the timely reporting so that rabies menace in India is checked and dog bite early case detection and management becomes the reality in near future under the national rabies control programme.

Conflict of Interest: No conflicts of interest.

Source of Funding: No funding sources.

Ethical Clearance: The study was approved by the Institutional Ethics Committee of Hassan Institute of Medical Sciences, Hassan, Karnataka in the year 2017.

Acknowledgement

We would like to acknowledge the Epidemiologist and Data entry operator of the District Surveillance Office, Hassan for providing the required data for this study from the IDSP portal. We also wish to acknowledge the Medical Officers and other staff of all the 24 health centres for their support and cooperation during the study.

REFERENCES


The Impact of Oral Health Literacy on Oral Hygiene, Gingival Status and Dental Caries among Young Adults in a South Indian City

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ABSTRACT

Introduction: Oral health literacy is the degree to which individuals have the capacity to obtain, process, and understand basic oral health information. A common reason for misunderstanding health instructions may be the patient’s low oral health literacy skills.

Material and Method: The study design was a descriptive cross sectional, which included 457 study participants. They were selected using stratified random sampling. Oral health literacy was assessed using Rapid Estimate of Adult Literacy in Dentistry (REALD-30). Dental caries and gingival status was assessed according to the methods described in WHO Oral Health Survey.

Results: The overall mean REALD-30 score of the participants was 18.1±4.8. The mean REALD-30 scores were lowest (14.6±4.4) among students in the low socioeconomic status. The oral health literacy scores of individuals who brush their teeth twice and rinse their mouth after meals were significantly higher. The mean number of teeth with gingival bleeding and dental caries were significantly low in study participants with high oral health literacy.

Conclusion: It was concluded that the overall oral health literacy of the study population as moderate and it does have an impact on the oral health status of the study population.

Keywords: Health education, Oral health, Decay, Students, Gingivitis

Introduction

Oral self-care is a constituent of general health and it encompasses various activities ranging from self-examination, prevention and diagnosis to seeking professional oral health care.¹ Dental caries and periodontal disease are the most common oral diseases affecting mankind. Both of them are multifactorial conditions with a complex interplay of biological, genetic and environmental factors.²

The recent advances in dental treatment modalities alone will not be sufficient to reduce oral health discrepancies nor eradicate these conditions. The most effective way for the people of the community to attain good oral health is through promotion of health.² Health literacy has been acknowledged as one of the elements of staying healthy. It is the ability of a person to understand instructions on prescription, appointment cards, health education pamphlets, doctor’s directions and consent forms.³

Although healthcare professionals generally assume that the health explanations and instructions given to patients and families are readily understood, in reality these instructions are frequently misunderstood. A
common reason for misunderstanding health instructions may be the patient’s low health literacy skills. Poor health literacy is linked with worse health and reduced understanding of prevention, maintenance, and self-care instructions provided by the health care professional.

Oral health literacy (OHL) is the degree to which individuals have the capacity to obtain, process, and understand basic oral health information and services needed to make appropriate health decisions. The information provided to them by their dentists and the communication skills of the dental team contribute to a patient’s oral health literacy that in turn results in improved oral health outcomes.

It was suggested that the complexity of both verbal and written oral health communications create a significant barrier to improving oral health and that oral health literacy is required in order to promote oral health and to prevent oral diseases.

Oral health literacy levels can be estimated with the previously validated instrument called Rapid Estimate of Adult Literacy in Dentistry (REALD-30). Studies conducted using this instrument reveals that those with incorrect knowledge of dental questions and fair/poor oral health status had greater odds of having a low literacy level than those with correct knowledge.

The precise relationship between OHL and oral health outcomes has not been established, but it has been conceptualized that there is interplay between oral health literacy, culture, socioeconomic status, education and health system in determining oral health related outcomes.

Late Adolescent life is a critical period of transition with personal responsibility. Individuals in this period can be targeted for preventing dental diseases and developing better oral health. Assessing the effect of oral health literacy among this age group is a crucial component in development prevention oriented oral health programs in the future. Although recently gaining more attention, there has been minimum research in the field of oral health literacy or, more specifically, the impact of oral health literacy on oral health related outcomes among adolescent Indian population.

Therefore the present study was conducted with the aim of evaluating the impact of oral health literacy on Oral Hygiene, Gingival status and Dental caries among young adults in Chennai City, India.

Materials and Method

The design of the present study was descriptive cross sectional, which includes study participants pursuing their undergraduate degree in a private University in Chennai. The principal investigator was trained and calibrated prior to the start of the study. A pilot study was conducted among 50 participants to validate the assessment form and to get the required sample size. The estimated sample size was 457 with 90% power and margin of error at 5% with 95% confidence level.

The subjects were selected using stratified random sampling where each faculty of studies forms strata. After obtaining the list of students in each faculty of studies, they were randomly selected till the required sample size is achieved. Students were selected from engineering, arts & science and polytechnic courses. Students from medical, dental and paramedical courses were not involved to prevent confounding bias. The nature and purpose of the study was explained to them and written informed consent was obtained. They were involved in one to one interview once they satisfy the inclusion criteria.

Inclusion Criteria:

1. UG students from non-medical backgrounds.
2. They should be able to read, write and speak English language.
3. Students who have studied English as their first language in schools.

Oral health literacy was assessed using a validated instrument, the Rapid Estimate of Adult Literacy in Dentistry (REALD-30). It includes 30 dentally-related words arranged in order of increasing difficulty. The participants were asked to read the words loudly. They were asked to read only the words which are familiar and which they can pronounce correctly. To score REALD-30 one point is given to each word pronounced correctly and then summed to get an overall score. The score has a possible range of 0 (lowest literacy) to 30 (highest literacy).

Socioeconomic status was assessed using Modified Kuppuswamy Scale. The various dimensions taken under consideration to obtain a composite score are the education and occupation of the family head, together with total monthly income. The score ranges from 3 (Lower class) to 29(Upper class).
Oral hygiene status was assessed using Oral Hygiene Index - Simplified. Dentition and gingival status was assessed according to the methods described in WHO Oral Health Survey, fifth edition.

The data was analysed using Statistical Package for Social Sciences, IBM Corporation, SPSS Inc., Chicago, USA version 21 software. Independent t test and one way ANOVA was used to assess the level of significance which was kept as p < 0.05. Post hoc analysis and multiple group comparisons were made using either Tukey’s HSD test or Tamhane’s test following homogeneity of variance test.

Results

The total number of participants in the study was 457 which included 256 (56%) males and 201 (44%). The age of the participants ranged between 17 to 25 years with the mean age of 19.9±1.8. Majority of the students were from middle class. The overall mean REALD-30 (OHL) score of the participants is 18.1±4.8. Although the oral health literacy score for females is slightly higher (18.2±5.0) than males (17.9±4.8), statistically it was not significant. The mean REALD-30 scores were lowest among students in the lower socioeconomic status and the differences were found to be statistically highly significant. (Table 1)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean REALD ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>256</td>
<td>56</td>
<td>17.9±4.8</td>
</tr>
<tr>
<td>Female</td>
<td>201</td>
<td>44</td>
<td>18.2±5.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean REALD ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>153</td>
<td>33.5</td>
<td>18.2±4.8</td>
</tr>
<tr>
<td>Arts and Science</td>
<td>152</td>
<td>33.3</td>
<td>17.7±5.2</td>
</tr>
<tr>
<td>Polytechnic</td>
<td>152</td>
<td>33.2</td>
<td>18.3±4.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean REALD ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper class</td>
<td>63</td>
<td>13.8</td>
<td>19.4±5.1</td>
</tr>
<tr>
<td>Upper Middle</td>
<td>112</td>
<td>24.5</td>
<td>18.9±3.9</td>
</tr>
<tr>
<td>Lower Middle</td>
<td>112</td>
<td>24.5</td>
<td>19.1±4.8</td>
</tr>
<tr>
<td>Upper Lower</td>
<td>119</td>
<td>26</td>
<td>17.1±4.9</td>
</tr>
<tr>
<td>Lower</td>
<td>51</td>
<td>11.2</td>
<td>14.6±4.4</td>
</tr>
<tr>
<td>Total</td>
<td>457</td>
<td>100</td>
<td>18.1±4.8</td>
</tr>
</tbody>
</table>

Table 2: Distribution of subject based upon oral hygiene and REALD-30 scores

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean REALD scores ± SD</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brushing frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once</td>
<td>367</td>
<td>80.3</td>
<td>17.6±5.0</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Twice</td>
<td>90</td>
<td>19.7</td>
<td>20.1±3.7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean REALD scores ± SD</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rinsing after meals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>255</td>
<td>55.8</td>
<td>19.7±4.2</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>No</td>
<td>202</td>
<td>44.2</td>
<td>16.0±4.9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean REALD scores ± SD</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHI - S</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>138</td>
<td>30.2</td>
<td>18.5±4.9</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Fair</td>
<td>225</td>
<td>49.2</td>
<td>19.0±4.2</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>94</td>
<td>20.6</td>
<td>15.2±5.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Distribution of subjects based upon demography and REALD-30 scores

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean REALD ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>256</td>
<td>56</td>
<td>17.9±4.8</td>
</tr>
<tr>
<td>Female</td>
<td>201</td>
<td>44</td>
<td>18.2±5.0</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td>153</td>
<td>33.5</td>
<td>18.2±4.8</td>
</tr>
<tr>
<td>Arts and Science</td>
<td>152</td>
<td>33.3</td>
<td>17.7±5.2</td>
</tr>
<tr>
<td>Polytechnic</td>
<td>152</td>
<td>33.2</td>
<td>18.3±4.7</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper class</td>
<td>63</td>
<td>13.8</td>
<td>19.4±5.1</td>
</tr>
<tr>
<td>Upper Middle</td>
<td>112</td>
<td>24.5</td>
<td>18.9±3.9</td>
</tr>
<tr>
<td>Lower Middle</td>
<td>112</td>
<td>24.5</td>
<td>19.1±4.8</td>
</tr>
<tr>
<td>Upper Lower</td>
<td>119</td>
<td>26</td>
<td>17.1±4.9</td>
</tr>
<tr>
<td>Lower</td>
<td>51</td>
<td>11.2</td>
<td>14.6±4.4</td>
</tr>
<tr>
<td>Total</td>
<td>457</td>
<td>100</td>
<td>18.1±4.8</td>
</tr>
</tbody>
</table>

Table 2: Distribution of subject based upon oral hygiene and REALD-30 scores

Independent t test and One Way ANOVA, * Highly significant
One Way ANOVA followed by Tukey’s HSD, * Very Highly Significant

Most of the participants (80.7%) brush their teeth only once and about 55.8% rinse their mouth after every meal. The OHL scores of individuals who brush their teeth twice and rinse their mouth after meals were significantly higher. Nearly half of the participants (49.2%) had fair oral hygiene. (Table 2) Individuals with poor oral hygiene had the lowest OHL scores (15.2) when compared to other two groups and the differences were found to be statistically very highly significant. (Table 3)

The mean number of teeth with gingival bleeding was high (8.1±2.0) among individuals with low OHL when compared those with moderate (6.8 ± 3.6) and high literacy (4.4 ± 3.8). Multiple comparisons of different groups reveal that the differences were statistically very highly significant. (Table 4 and 5)

Table 4: Distribution of subjects according to gingival bleeding, dental caries and their association with Oral health literacy groups

<table>
<thead>
<tr>
<th>Oral Health Literacy groups</th>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Gingival Bleeding (Mean ± SD)</th>
<th>Dental Caries (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt;13)</td>
<td>90</td>
<td>19.7</td>
<td>8.1 ± 2.0</td>
<td>2.5 ± 1.9</td>
</tr>
<tr>
<td>Moderate (13.0 to 20.0)</td>
<td>218</td>
<td>47.7</td>
<td>6.8 ± 3.6</td>
<td>2.3 ± 2.0</td>
</tr>
<tr>
<td>High (20.1 to 30.0)</td>
<td>149</td>
<td>32.6</td>
<td>4.4 ± 3.8</td>
<td>1.8 ± 1.2</td>
</tr>
<tr>
<td>Total</td>
<td>457</td>
<td>100</td>
<td>6.3 ± 3.7</td>
<td>2.1 ± 1.7</td>
</tr>
</tbody>
</table>

Table 5: Comparison of gingival bleeding scores with different oral health literacy groups

<table>
<thead>
<tr>
<th>Oral Health Literacy groups</th>
<th>Mean Difference</th>
<th>P value</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.280</td>
<td>.000*</td>
<td>0.4895 - 2.0707</td>
</tr>
<tr>
<td>High</td>
<td>3.636</td>
<td>.000*</td>
<td>2.7216 - 4.5518</td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>-1.280</td>
<td>.000*</td>
<td>-2.0707 - 4.4895</td>
</tr>
<tr>
<td>High</td>
<td>2.356</td>
<td>.000*</td>
<td>1.4004 - 3.3128</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>-3.636</td>
<td>.000*</td>
<td>-4.5518 - 2.7216</td>
</tr>
<tr>
<td>Moderate</td>
<td>-2.356</td>
<td>.000*</td>
<td>-3.3128 - 1.4004</td>
</tr>
</tbody>
</table>

One Way ANNOVA followed by Tamhane’s test, * Very highly significant

The mean number of teeth affected by dental caries was also found to be high among subjects with low oral health literacy. Multiple comparisons demonstrate statistically significant difference between subjects with high and low literacy. (Table 6)
### Table 6: Comparison of dental caries scores with different oral health literacy groups

<table>
<thead>
<tr>
<th>Oral Health Literacy Groups</th>
<th>Mean Difference</th>
<th>P value</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Moderate</td>
<td>.178</td>
<td>.877</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>.681</td>
<td>.044*</td>
</tr>
<tr>
<td>Moderate</td>
<td>Low</td>
<td>-.178</td>
<td>.877</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>.502</td>
<td>.152</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>-.681</td>
<td>.044*</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>-.502</td>
<td>.152</td>
</tr>
</tbody>
</table>

One Way ANNOVA followed by Tamhane’s test, * Significant

### Discussion

Adolescence is a distinct period of development. During this period, the individuals are about to begin a new episode in their lives and the society legally considers them as an adult. Any changes in behaviour occurring during this period tends to last lifelong. The oral health literacy of the present study population was considered to be moderate with a mean REALD-30 score of 18.1±4.8, whereas studies conducted by Haridoss R et al., Aruna Devi et al. and Jamieson et al. showed a lesser mean REALD-30 scores. This may be due to the fact that the current study was done among college students in a metropolitan city. A higher mean REALD-30 score of 23.9±1.29 and 23.0±4.31 was obtained by Jones et al. and Wehmeyer et al. respectively. It should be acknowledged that these two studies were conducted among patients attending a dental OP, while the present study was done among students regardless of their dental visits.

There was no significant difference in the OHL scores across different genders of the study population which was comparable to a study conducted by Haridoss R et al. There was a significant difference in the oral health literacy among subjects with different socioeconomic statuses, with the upper class having the highest literacy and vice versa. These results are in agreement with the studies conducted by Divaris et al. and Lee JY et al.

Individuals who brush their teeth twice and those who rinse their mouth regularly after each meal have significantly higher OHL scores and this implies the fact that better oral health literacy results in improved oral health related behaviour. In the present study, the oral health literacy scores were significantly higher among individuals with Good and fair oral hygiene when compared to individuals with poor oral hygiene. These findings validate the importance of oral health literacy in improving personal oral hygiene. The mean number of teeth with gingival bleeding which is an indicator of gingivitis and the mean number of teeth affected by dental caries were significantly low in study participants with high oral health literacy. This endorses the impact of OHL on oral health status of the study population and these results are in agreement with most of the studies conducted elsewhere.

The limitations of the REALD-30, particularly that it measures word recognition only with no test of comprehension or function have been acknowledged. Since REALD-30 has been validated in English language, this prevents generalization of results beyond students who were from English medium of education. Low oral health literacy when assessed early can alert dental care providers, to improve communication skills with such patients. Proper interventions may be effective in patient amenability in dental programs.

### Conclusion

To conclude, the overall oral health literacy of the study population is considered as moderate and it does have an impact on the oral health status of the study population. Further analytical studies can be conducted to establish one to one causal relationship evaluating the effects of oral health literacy on different oral health related variables involving sufficient and equal number of subjects from different socioeconomic and cultural backgrounds.

**Conflict of Interest:** Nil

**Source of Funding:** Self
Ethical Clearance: Taken from the Institutional Review Board of Dr.MGR Educational and Research Institute (Deemed to be University)

REFERENCES


**Streptococcus anginosus** Throat Colonization in Healthy School going Children

Kusumakshi Nayak¹, Shobha K. L², Vishnu Prasad³

¹Assistant Professor, Department of Medical Laboratory Technology, SOAHS, ²Professor, Department of Microbiology, MMMC, ³Associate Professor, Department of Microbiology, KMC, MAHE, Manipal

**ABSTRACT**

**Background:** *Streptococcus anginosus* was most commonly considered as commensals and closely related to *Streptococcus pyogenes*. Recovery of this bacteria from the throats has been reported to exceed that of *S. pyogenes* in regions where streptococcal disease is endemic. Infection with these bacteria may cause acute rheumatic fever (ARF) and its sequelae rheumatic heart disease (RHD) in susceptible individual. Molecular mimicry and autoimmunity probably play a crucial role in the pathogenesis. M protein in streptococci shares structural similarities with cardiac proteins such as myosin and the antibodies produced in patient cross-react with both M protein and heart tissue leading to RHD that causes significant morbidity and mortality in developing countries. The incidence of ARF peaks between 5-15 years of age and high burden of RHD is seen in Asia. *Streptococcus anginosus* being the most common beta hemolytic group C streptococcus isolated from the human throat. The present study provides epidemiological clues of this bacteria which is necessary in developing preventive measures.

**Objective:** To study the prevalence of *Streptococcus anginosus* in throat among healthy school children.

**Method:** Throat swabs were collected after taking consent from 3,416 children. The organism were isolated in sheep blood agar and beta hemolytic organisms were identified as *Streptococcus anginosus* by Vitek 2 compact, an automated system.

**Result:** Out of 3416 throat samples only six samples had beta hemolytic *Streptococcus anginosus*.

**Conclusion:** The present study showed the presence of beta hemolytic *Streptococcus anginosus*. Further study regarding M genes are required for knocking the virulence factors by developing suitable vaccines.

**Keywords:** *S. anginosus*, emm gene, acute rheumatic fever, beta haemolytic streptococci, sheep blood agar

**Introduction**

The *Streptococcus anginosus* group of bacteria earlier known as the *Streptococcus milleri* group comprises three types of organisms, *Streptococcus anginosus*, *Streptococcus intermedius* and *Streptococcus constellatus* (¹). Later in 1989 in the United States it was proposed to rename these bacteria under one species name *S. anginosus* (²). These bacteria are present as commensal flora in the human oropharynx, gastrointestinal tract and frequently isolated from clinical specimen (¹). Usually, identification of *S. anginosus* to the taxonomic level of species is not performed because in general the speciation is not considered necessary for patient treatment and most of the bacteria are susceptible to penicillin (¹).

*S. anginosus* group bacteria have a propensity to cause pharyngitis, bacteremia, and other severe invasive infections (³). *S. anginosus* group is the most common beta-hemolytic group C streptococcus isolated from the human throat (²). The species diversity highlights the limits of Lancefield grouping by agglutination assays, the typically applied method in the diagnosis of streptococcal infections. Diagnosis of *S. anginosus* group infections...
is particularly difficult by widely available phenotypic methods due to an antigenic diversity within the species. Although most S. anginosus group isolates belong to the non-β-hemolytic oral streptococci, β-hemolytic strains are also found in all 3 species. Some S. anginosus group strains carry a typeable Lancefield group antigen, which belongs to group A, G, F, C (3).

The role of Lancefield group C beta-hemolytic streptococci (BHS) in causing endemic pharyngitis is still contentious, although Lancefield group C streptococci are implicated in the outbreaks of purulent pharyngitis and associated disorders (2). In India and other developing countries ARF and RHD is one of the major public health problems contributes to significant cardiac morbidity and mortality (5). The prevalence of RHD in children aged 5–15 years is highest in Africa, Australia, New Zealand and south central Asia (6) including India (7).

Little is known about the pathogenesis of S. anginosus group infections (3). Studying the epidemiology, disease mechanism and their resistance to antibiotics is significant to monitor this emerging pathogen. The present study is done to study the prevalence of S. anginosus among school going children.

Materials and Method

A cross sectional survey was conducted to estimate the prevalence of beta hemolytic streptococci among healthy school going children in Udupi. Total 3416 school children of 5-15 years age group from 5 educational blocks of Udupi District were included in this study. Throat swabs were collected form the posterior pharyngeal wall using sterile cotton swab (Himedia) and transported to the laboratory immediately and processed. Throat samples were inoculated on to the sheep blood agar (Hi Media) plate and incubated aerobically at 37°C in the carbon dioxide incubator for overnight. Next day colony morphology was studied. Gram staining was done for Small, circular, semitransparent colonies with beta hemolytic zone around them. Catalase test, and esculin hydrolysis test were performed. Primary antibiotic susceptibility testing was performed using bacitracin disk for all the Gram positive beta hemolytic cocci arranged in chains. Beta hemolytic colonies which showed Gram positive cocci arranged in chains were subcultured on sheep blood agar and used for further identification of organism. Beta hemolytic bacterial colonies were identified using Vitek 2 Copmact an automated system. Fresh culture on 5% sheep blood agar was used for the inoculum preparation.

Result

From 3,416 sample collected from healthy school children, 6 samples were showing the growth of beta hemolytic bacteria on sheep blood agar. And all the six isolates of the identified beta hemolytic isolates showed resistance to Bacitracin.

![Beta hemolytic colonies on SBA.](image)

The colonies were small, translucent and were Gram positive cocci arranged in short chains in Grams smear, catalase negative and esculin was not hydrolyzed. Further, the isolated bacterial colonies were identified as Streptococcus anginosus in Vitek 2 comact.

The prevalence of BHS in throat among school children was estimated as 0.175 % (95% CI). Distribution of BHS in the schools from where subjects were selected is shown in Table 1. The frequency distribution of BHS
among categories of schools, age group and gender is also shown in Table 1.

These six BHS cases were found in two of the educational blocks in the district. Male to female ratio was 1:1; where 4 children were studying in private schools and 2 in Government schools of urban area. All the 6 cases were migrants from North Karnataka and not originally from Udupi District. All the cases were found to be among 7-10 years age group children. They had no previous family history of bacterial colonization or infections or its sequelae. All the children were normal in their health status without showing any of the symptoms.

Table 1: Positive cases of BHS in Udupi District

<table>
<thead>
<tr>
<th>Educational block</th>
<th>Area</th>
<th>School type</th>
<th>Age (Yr.)</th>
<th>Gender</th>
<th>Height</th>
<th>weight</th>
<th>Family history</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rural</td>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>+</td>
<td>Private</td>
<td>8</td>
<td>Female</td>
<td>2.5</td>
<td>18</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Private</td>
<td>8</td>
<td>Male</td>
<td>2.6</td>
<td>21</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Private</td>
<td>9</td>
<td>Male</td>
<td>2.6</td>
<td>22</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>+</td>
<td>Private</td>
<td>7</td>
<td>Female</td>
<td>2.4</td>
<td>17</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Govt.</td>
<td>10</td>
<td>Female</td>
<td>3.6</td>
<td>25</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>Govt.</td>
<td>10</td>
<td>Male</td>
<td>3.4</td>
<td>24</td>
<td>No</td>
</tr>
</tbody>
</table>

Discussion

Morbidity is a most important public health concern among school children as it can affects their normal growth and development in all the aspect. As found by school health programs, the common complaints seen in this school children are malnutrition, Vitamin A deficiency, dental caries, upper respiratory tract infection and anemia (8).

The association between host and microbes is multifaceted. The normal throat flora appears to be a remarkably stable (9). The various host factors and microbial features can influence the process of infection. The human throat is a major biological site for various bacteria that can reach neighboring sites and cause mild to severe infections (10). The epidemiology of streptococcal infections in India is quite different from that of the developed countries, but some serotypes are more common than others within a population in different geographical locations (11). However, Streptococcal infections are one of the major problems in medical and health care settings (12).

In the present study we investigated very low prevalence of BHS in children of age between 7 - 10 years. Similar studies conducted in Karnataka showed speckled result of BHS concentration. The study conducted in Mandya reported 2.2% BHS, among which only 5 cases had Group C organisms (13); 11% BHS were isolated in Mangalore where both GAS and GGS were recovered from throat swabs whereas study conducted in other areas of Mangalore city found 5% of BHS those isolated as GAS (14). In Hubli, 13.41% BHS were isolated with 7 cases of group C BHS from asymptomatic school children (15). Further, study held at Bangalore city reported 60% of Group A BHS in one of the study (16). The low prevalence of BHS carriage in the present study may be due to the geographical location of the study which is free from air pollution and overcrowding. Throat flora is affected by many demographic factors such as climate, host age, extent of exposure to the infectious agent and vaccination (8). Studies that determine the BHS carriage rate among school children are important in public health practices to help in the prevention of streptococcal infections and their serious complications (17).

All the cases were migrants from North Karnataka where the prevalence of BHS is high and not from Udupi originally. One of the study near Gulbarga reported 11.3% of BHS prevalence in asymptomatic school children (18). The high prevalence of BHS in this village may be due to that the village is situated in a typical agricultural farmland represent spring climate condition, poor hygienic place and lack of basic treatment facilities. Another study conducted in Hubli isolated 13.41% of BHS (15).
According to most of the studies, 5 to 15 years age group children were affected more with streptococcal throat colonization (19) (20) (21). This might be due to high exposure of this age group children to the external environment and lack of awareness about the transmission of microbial diseases (20) (22). In our study we found equal distribution of streptococcal throat colonization between genders. Few studies showed similar results (20) whereas in some of the studies majority of them were males (14). Crowding and poor hygiene increases the chance of the transmission of Streptococci (20). It can be transmitted from person to person via aerosols after sneezing or coughing, and also via fomites. Crowded environments, which are often experienced in schools, refugee camps, and military units, are favorable to transmission (23).

All the BHS cases were identified as S. anginosus. BHS other than Group A, particularly group C and G are capable of producing significant acute pharyngitis (10). S. anginosus is part of the human bacteria flora, but in certain circumstances it can cause invasive diseases including brain and liver abscesses (24). However during the last decade an increasing number of reports have been published emphasizing the role of S. anginosus as important bacterial pathogens. One of the reasons why the true pathogenic potential of these species may have previously been missed is due to failure in identifying streptococcal isolates to species level in the routine diagnostic laboratory (25). All the BHS cases were collected during the winter season. Streptococcal throat infection are common during the winter and early spring in a temperate climate (26). Therefore, constant monitoring with intermittent health checkup may support to control these morbidities for better health of the future generation (27).

Isolates were identified by the automated VITEK 2 compact system. Although molecular techniques are considered to be the most sensitive and specific, VITEK 2 GP identification card was found to provide reliable results for the identification of Gram-positive cocci under routine laboratory conditions and no false-positive results were described with the VITEK 2 system for the identification of S. anginosus (28).

**Conclusion**

The present study showed six strains of beta hemolytic S. anginosus. Further study regarding M genes are required for knocking the virulence factors by developing suitable vaccines. Since RF/RHD are illnesses which were often encountered in school children among socially and economically disadvantaged populations stronger support for streptococcal surveillance programs should be encouraged in endemic areas (29).

**Ethical Clearance:** Taken from Institutional ethical committee of Manipal Academy of Higher Education

**Source of Funding:** None

**Conflict of Interest:** None

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26. Gunnarsson RK, Holm SE, Söderström M. The prevalence of beta-haemolytic streptococci in throat specimens from healthy children and


At What Extent Does Cardiospermum Halicacabum Relieves Chronic Joint Pain among Elderly? An Experiment in Urban Community of Tamilnadu, India

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Abstract

Background: One of the major health problems among elderly is osteoarthritis which leaves them suffering from chronic joint pain. Prescription of pharmacological measures such as analgesics to treat the joint pain causes many adverse effects and non-compliance. This study attempts to inquire the use of herb as a pain-relieving measure among elderly as it does not produce any side effects and easily available at affordable costs.

Objective: To evaluate the effectiveness of Cardiospermum halicacabum Leaves Soup on Chronic Knee pain among elderly population

Method: Pre-experimental study was conducted among 30 elderly persons residing at Dharmapuri, South India. Pre-test level of chronic knee pain among elderly was assessed through Numeric Pain Intensity Rating Scale. 100ml of freshly prepared Cardiospermum halicacabum leaves soup was given to the participants once in a day for 21 days and then post-test level of chronic knee pain was assessed.

Results: There was significant difference (p<0.05) found between mean pre-test (7.6 ± 0.83) and post-test (2.73 ± 1.04) pain score. The pretest level of pain has significant association (p<0.05) with the occupation, type of work and BMI.

Keywords: Cardiospermum halicacabum Leaves Soup, Elderly, Chronic knee pain.

Introduction

Ageing is a natural process. Old age can’t be healed, but it can be protected and extended. There is a remarkable increase in the growth of elderly population world-wide. According to World Population Prospects - 2017 Revision, the number of elderly persons aged 60 years or above is expected to be more than double by 2050 and more than triple by 2100, rising from 962 million globally in 2017 to 2.1 billion in 2050 and 3.1 billion in 2100. The international population aged 60 or above is growing faster than all younger age groups¹. Census of India, 2011 reported around 104 million elderly persons aged ≥60 years. The elderly population in India has significantly grown from 5.6% in 1961 to 8.6% in 2011².

As elderly population increases, the morbidity associated with aging also increase. Currently, the leading causes of death and illness among older adults and elderly are shifted from infectious and parasitic diseases to noncommunicable diseases and chronic conditions³. These chronic conditions include hypertension, high cholesterol, arthritis, diabetes, heart disease, cancer, dementia, and congestive heart failure⁴. Osteoarthritis is one of such common health problems among elderly which leaves them suffering from chronic joint pain. The prevalence of symptomatic knee osteoarthritis in the
United States is more than 10% among elderly aged 60 years or older\(^5\). A community based cross-sectional study conducted in an urban community of India reported the prevalence of 41% osteoarthritis among elderly\(^6\).

Though osteoarthritis among elderly does not directly leads to mortality, it has huge burden among them by causing chronic pain and affecting their mobility and Quality of Life\(^5-7\). Traditionally, health care providers depend heavily on the use of NSAIDs to treat the pain of osteoarthritis. The cardiovascular, gastrointestinal, renal and hepatic toxicities of NSAIDs have limited their use, particularly in the elderly. Many non-pharmacologic approaches are available but underused and which may be better pain management option to avoid adverse effects, non-compliance and poly-pharmacy in elderly\(^7\). Treatment with medicinal plants is considered very safe as there is no or minimal side effects. In India, Plants have been used for medicinal purposes long before prehistoric period. World Health Organization has estimated that 80% of the population worldwide rely on herbal medicines for some aspect of their health care needs and reported that around 21,000 plant species have the potential for being used as medicinal plants. Use of herbal treatments is independent of any age groups and the sexes\(^8\). Cardiospermum halicacabum (Figure – 1) commonly known as “Balloon Vine” is one of the medicinal herbs has been used as anti-inflammatory, antibiotic, antipyretic, antiparasitic and as analgesic. Studies were reported the extract of its leaves exhibits significant anti-arthritic effect\(^9-10\). The present study is an attempt to evaluate the effectiveness of Cardiospermum halicacabum Leaves Soup on Chronic Knee pain among elderly population residing at an urban community of South India.

**Method**

A pre-experimental study with one group pre-test post-test design was used to measure the effectiveness of Cardiospermum halicacabum Leaves Soup on Chronic Knee pain among elderly population residing at an urban community of Dharmapuri, Tamilnadu, South India. 30 elderly men and women aged 60 years or above, suffering from knee pain for past ≥1 year and having pain score more than 4 in Numeric Pain Intensity Rating Scale were selected to participate in this study through non-probability convenience sampling technique. The elderly persons who were already on some other treatment for chronic knee pain had been excluded. The study was conducted after obtaining the institutional ethical clearance and informed consent from the participants.

The demographic and clinical information were gathered by using structured interview technique and Body Mass Index was calculated through the formula “Weight/Height in m\(^2\)”. Chronic knee pain was assessed through Numeric Pain Intensity Rating Scale. The participants were requested to rate their pain perception in the scale ranging from 0 to 10 with higher scores indicating greater pain intensity. The levels of knee pain were interpreted as mild (pain score 1 – 3), moderate (pain score 4 – 6) and severe (pain score 7 – 10). Test–retest reliability of the Numeric Pain Intensity Rating Scale is high among literate and illiterate patients with rheumatoid arthritis (r = 0.96 and 0.95, respectively) and the construct validity has found to be highly correlated (r = 0.86 to 0.95) with the Visual Analog Scale in patients with rheumatic and other chronic pain (pain>6 months)\(^11-12\).

During the initial contact with the participants, the pre-test level of knee pain was measured, and the participants were explained about the intervention. After the pre-test, 100 ml of freshly prepared Cardiospermum halicacabum leaves soup was provided to each participant once in every morning for 21 consecutive days. Cardiospermum halicacabum leaves soup is clear liquid prepared by adding 1 pinch of asafoetia, 10 gm of chopped Balloon Vine Leaves, 1 pinch of salt and 1 teaspoon cumin seeds powder in 100 ml of drinking water. It was boiled for two minutes and the extracts were filtered. The post-test was done after completing the 21 days intervention.
Results

Among the participants, nearly half (47%) of them belonged to the age group of 60 – 64 years, 30% belonged to the age group of 65 – 69 years and remaining 23% of them were in the age of ≥70 years. 43% were males and 57% were females, majority (67%) of them were married and 30% were widow/widower. Half (50%) of them were pensioner and 20% of the participants were engaged in coolie works. The monthly income of 3/4th of the participants was less than Rs. 5000. 40% of them were known diabetics and 27% were known hypertensive patients. 47% and 30% of them involved in heavy and moderate types of works respectively. Nearly half (47%) of them had overweight (BMI above 25 to 29.9). 90% of the participants were suffering from chronic knee pain for past 1 to 5 years and remaining 10% of them were suffering since more than 5 years. 40% of the elderly had reported of having continuous knee pain, 37% reported intermittent knee pain and remaining 23% reported knee pain during the time of work only.

During pre-test, 90% of the participants were suffering from severe knee pain and 10% of them were suffering from moderate knee pain. Whereas, in post-test, none of them had severe knee pain, majority (77%) of them reported mild knee pain and only 23% were suffering from moderate knee pain (Figure-2).

![Figure 2: Pre-test and post-test level of knee pain among the participants](image)

Table 1: Effectiveness of Balloon Vine Leaves Soup on chronic knee pain

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Variables</th>
<th>Pre-test</th>
<th>Post test</th>
<th>Mean difference</th>
<th>Paired ‘t’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Chronic knee pain.</td>
<td>7.6</td>
<td>2.73</td>
<td>4.87</td>
<td>16.41*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.83</td>
<td>1.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at P< 0.05

Discussion

The present study revealed the high prevalence (47%) of overweight among the elderly population in urban community. The similar findings were reported in two different studies on the prevalence of overweight and obesity among elderly population of urban communities from Chennai (39% of overweight and obesity) and Puducherry (46% of overweight and obesity). In pre-test 90% of the elderly reported severe knee pain and it is associated (p<0.05) with their Body Mass Index. The finding is consistent with the study conducted by Ray, et al which reports, both BMI and abdominal obesity are associated with chronic knee pain in the elderly.

After administration of Cardiospermum halicacabum leaves soup, none of the participants had severe knee pain and majority (77%) reported mild knee pain only. Comparison of mean pain scores before and after the intervention revealed that the elders experienced the pain relief at greater extent in post-test. The mean pre-test score of knee pain was 7.6 ± 0.83 which has drastically brought down to 2.73 ± 1.04 after the intervention. The authors could not trace any published research work on human subjects regarding the effect of Cardiospermum halicacabum on arthritic pain. However, the studies related to pharmacognostic, physio-chemical and antiarthritic properties of the Cardiospermum halicacabum leaves brought out the significant anti-inflammatory properties of the leaves on arthritis. The herb is well recognized and widely used native medicine to treat arthritic pain in Tamilnadu. It is prepared and consumed by the people as varieties of recipes like “Dosa” and “Soup”. The participants of this study did not report any discomfort and adverse effects during and after the intervention. Further, they expressed
their satisfaction with the effect of Cardiospermum halicacabum leaves in reduction of their knee pain. The authors recommend further community-based research studies with large sample size in order to validate the effect of Cardiospermum halicacabum leaves on chronic knee pain among elderly.

Conclusion

The study has revealed the effect of Cardiospermum halicacabum leaves in reducing chronic knee pain among elderly. It has brought out the significance of herbal and alternative therapies. Public Health Nurses need to consider the valid and cost-effective alternative therapies in treating minor ailments.

Conflict of Interest: None declared

Source of Funding: Self

Ethical Clearance: The study was approved by the institutional ethical committee

REFERENCES


Assessment of Dental Caries Prevalence among Adolescents Aged 12 To 15 Years in Faridabad, India

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ABSTRACT

Background: Caries incidence rates among population vary according to geographical location and socioeconomic status of individuals. This study aims at assessing the dental caries prevalence among 12 to 15 years old school children in Faridabad, Haryana.

Material & Method: The data for the present cross-sectional study was collected from the school oral health programs conducted by the department of Public Health Dentistry from May 2017 to December 2018 in Faridabad Block. Comparison of caries among rural and urban dwellers, private and government schools, and males and females was done through mean DMFT scores.

Results: A total of 1921 students were examined. Mean DMFT for the study population was 0.86 ± 1.617. The prevalence of dental caries was 45.13%. SiC index for the study population was 2.22.

Conclusion: The difference in dental caries prevalence between urban and rural population indicates towards a need of strategy building towards managing the disease burden and prevalence in both the populations differently.

Keywords: caries experience, disease burden, adolescents, prevalence

Introduction

South Asia and especially India stands out as a region with high burden of dental disease and minimal change in per-capita oral health care needs.⁴, ² As a major contributor to this disease burden, measuring dental caries in communities is an important endeavor in providing baseline data for future policy and public health interventions. Dental caries is a global experience. It affects human beings of all ages universally and is a major dental health problem among adolescents.

Studies have shown that geographical factors are related to distribution and prevalence of dental caries.⁵ Additionally, lifestyle and cultural factors also influence the prevalence of oral disease.⁴, ⁵ Therefore, measuring dental caries prevalence locally is important to design locally effective programs for reduction of caries.

The age group of 12 to 15 years is the time when all the permanent teeth have erupted in an individual’s mouth.⁶ This is also the time when an individual begins exerting independence in one’s dietary behaviors. The adolescent is also able to adopt and implement oral health behaviours taught to them in an effective manner. Therefore, age group of 12 to 15 years is an important group for assessment and implementation of preventive intervention for dental caries. Subsequently, knowing the dental caries prevalence in this population becomes essential.

A systematic review of literature of dental caries prevalence among Indian children since past 25 years has
shown a prevalence rate of 50.84% to 62.41%.

Studies in various parts of India showed that caries incidence rates among 12 to 15 year population vary according to geographical location and socioeconomic status of individuals. Therefore, it is necessary to understand dental caries prevalence in this population. Hence, the present study aims at determining the dental caries prevalence among 12 to 15 years old school children in government and private schools in Faridabad, Haryana.

Methodology

The data for the present cross-sectional study was collected from the school oral health programs conducted by the department of Public Health Dentistry from May 2017 to December 2018. The study protocol was approved from the institutional ethics committee of Manav Rachna Dental College, Faridabad. Both private and government schools in Faridabad block of Faridabad district of Haryana state, India were included in the study. Convenience sampling was done. All students of the designated schools aged 12 to 15 years and present on the day of examination were screened for dental caries experience by a trained team of dentists and interns.

Prior permission was taken from the schools in Faridabad for conduct of oral health screening programs and recording of data. Written informed consent was taken from the parents regarding screening of their wards for oral diseases. Verbal consent was also taken from the participant. Decayed, missing and filled teeth were recorded for each student separately. The adolescents who required dental treatment were referred to the dental college for meeting their dental needs. Response rate was 100% because toothpaste and a toothbrush were distributed as participation incentives. Oral health education was also provided to all the adolescents after oral examination. While four dentists remained constant throughout the program, 4 dental interns were trained and standardized on a quarterly basis according to their postings in the department.

Training was conducted at two levels. The first training was conducted at the academic level, where, after a theoretical brief of the techniques, the examiners were demonstrated the methodology of examination and data acquisition. Thereafter, the examiners were trained, standardized and calibrated (kappa ≥ 0.8) by one of the authors for clinical oral examination. Periodic supervisory checks were done during the survey to ensure consistency.

The examination was carried out using standardized techniques for infection control. On the day of examination, the students were screened under natural light using mouth mirror and CPI probe. The student was made to sit upright on a chair. Decayed, missing and filled teeth were considered and recorded separately. A tooth was considered decayed if it had dental caries or was a candidate for dental treatment due to improper, fractured or loose restorations. Temporary restorations were also considered as decay. A tooth was considered filled if it had permanent restorations or crowns due to treatment of dental caries, while it was considered missing if it was extracted or lost because of dental caries. The decayed teeth were represented by D, missing by M and filled by F. A total DMFT score for each student was calculated by adding D, M and F scores. Apart from the DMFT scores, demographic data was taken from the students. This included the age, gender and class of the student. The location of school was classified as urban or rural. The schools were also divided as government and private schools.

The data was entered into Microsoft excel software. Statistical analysis was done through SPSS software (IBM Corporation, Chicago, USA) version 22. Descriptive data and frequency distribution according to demographic variables was obtained. Comparison of caries among rural and urban dwellers, private and government schools, and males and females was done through mean DMFT scores.

Results

Data from 3 private schools and 6 government schools was assessed from the period of May 2017 to December 2018. A total of 1921 students were examined for the age group of 12 to 15 years. These students belonged to classes from 7th grade to 11th grade. Out of the 1921 students examined, 720 students belonged to private schools, while 1201 students belonged to government schools. There were more male students (n = 1058) as compared to female students. Also, number of urban students (n = 1232) was greater than number of rural students. Age-wise frequency distribution and demographic distribution of the study sample is shown in Table 1.
Table 1: Demographic Characteristics of Study Population

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1058</td>
<td>55.1%</td>
</tr>
<tr>
<td>Female</td>
<td>863</td>
<td>44.9%</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1232</td>
<td>64.1%</td>
</tr>
<tr>
<td>Rural</td>
<td>689</td>
<td>35.9%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 year</td>
<td>455</td>
<td>23.7%</td>
</tr>
<tr>
<td>13 year</td>
<td>491</td>
<td>25.5%</td>
</tr>
<tr>
<td>14 year</td>
<td>540</td>
<td>28.2%</td>
</tr>
<tr>
<td>15 year</td>
<td>435</td>
<td>22.6%</td>
</tr>
</tbody>
</table>

Table 2: DMFT Score and Number of Teeth Involved

<table>
<thead>
<tr>
<th>DMFT Score</th>
<th>Number of Teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1054</td>
</tr>
<tr>
<td>1</td>
<td>592</td>
</tr>
<tr>
<td>2</td>
<td>123</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
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<td>6</td>
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</tr>
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<td>12</td>
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<td>8</td>
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<td>12</td>
<td>2</td>
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<tr>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>2</td>
</tr>
</tbody>
</table>

The DMFT score-wise number of teeth involved is presented in Table 2. Mean DMFT for the study population was $0.86 \pm 1.617$. The prevalence of dental caries was 45.13%. SiC index for the study population was 2.22.

The mean DMFT for urban school children aged 12 to 15 years was $1.36 \pm 2.087$. The prevalence of dental caries was 53.05%. SiC index was 3.51. For the urban school children, the prevalence of dental caries was 40.38%. The mean DMFT score was $0.55 \pm 1.506$, while the SiC index was 1.45.

Discussion

Dental caries has remained the most prevalent dental disease globally. The age standardized prevalence of dental caries has been found to be 34.1% in 2015. Approximately 2.5 billion people in the world suffer from dental caries. With an increase in global population, the burden of dental caries has also increased with an increase in number of dental caries cases worldwide. The age standardized prevalence of untreated dental caries in south Asia was found to be 40.5% in 2010. This prevalence is above the global average.

The mean prevalence of dental caries among 12 and 15 year individuals has been found to be 49% and 60% respectively. In the present study, we found the prevalence to be 45.13% which is lower than the mean national prevalence obtained through a meta-analysis by Janakiram et al in 2018. However, it is still higher than the global prevalence rate of untreated dental caries. The same meta-analysis, mean dental caries prevalence in northern Indian population was found to be 61% and 76% respectively for 12 and 15 year old population. One of the reasons for lower prevalence of dental caries prevalence could be high level of fluoride in water in these areas that may be responsible for lower occurrence of dental caries. Additionally, being in vicinity of the national capital, and being a part of the national capital of India, Faridabad district has a good availability of dental health education and care facilities. This may have an impact on dental caries prevalence through oral hygiene maintenance. Similar to the above observations, the SiC index of the present study population (SiC = 2.22) was lower than the index for the Indian population in meta-analysis by Janakiram et al, where the SiC index was 3.12 and 5.14 for 12 and 15 year population. However, a study by Kundu et al (2015) on prevalence of dental caries shows a SiC index of 2.90 and 4.10 in 12 and 15 year age respectively. This is closer to the index score obtained in the present study.

The mean DMFT score reported of the present study population was $0.86 \pm 1.617$. This was comparable to a recent study by Shah et al (2017) in the neighboring Ballabgarh block, where DMFT scores for 12 to 15 year age group was found to be $0.67 \pm 1.12$. However, the prevalence rate of dental caries in that study was recorded to be 31.3%, which was lower than the rate of present study. However, the study by Shah et al was conducted in rural areas. In the present study, if the rural schools are considered independently, the prevalence rate of dental caries is found to be 40.38%, while the mean DMFT index is found to be $0.55 \pm 1.506$ which is comparable to the index score in the study by Shah et al.
The results from the present study showed that there was a difference in prevalence rates, DMFT scores and SiC index scores of urban and rural population. The urban population had a higher rate of dental caries as well as DMFT score. This was in accordance with other studies conducted in urban and rural areas of Bhopal and Telangana where mean DMFT scores of urban population were found to be higher than DMFT scores for rural areas. This might indicate the impact of refined and high-carbohydrate diet in dental caries, as urban dwellers are more likely to take high sugar and high carbohydrate diet.

The study had some limitations. Only the schools that agreed to participate in screening activities were included in this study. However, due to high number of patients and schools screened by the institution each year, the total number of schools included in this study is a significant number among the schools of Faridabad block. This study was able to determine the prevalence of dental caries among 12 to 15 year old individuals in urban and rural Faridabad. As the newly erupted permanent dentition, teeth in this age group need care to prevent loss of tooth, pain and other functional disability in younger years of life. The difference in dental caries prevalence among rural and urban population could also be determined in this study.

**Conclusion**

Despite of high impetus on maintenance of dental health and prevention of dental disease, dental caries remains a significant oral health problem. High prevalence rates of dental caries indicate towards the need to devise newer and more effective strategies for preventing dental caries among communities. At the same time, there needs to be a thrust towards research on finding the factors responsible for occurrence of dental caries in the population of present study. The difference in dental caries prevalence between urban and rural population indicates towards a need of strategy building towards managing the disease burden and prevalence in both the populations differently.

**Ethical Clearance:** Ethical clearance to conduct the study was taken from the Institutional ethics Committee of Manav Rachna Dental College, Faridabad.

**Source of Funding:** Self funded

**Conflict of Interest:** None

**REFERENCES**


Comparative Study on Levels of Troponin (cTn), Creatine Kinase-Muscle/Brain (CK-MB), and B-type Natriuretic Peptide (BNP) in Patients with Acute Myocardial Infraction and Congestive Cardiac Failure

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ABSTRACT

Background: To diagnose a patient with acute myocardial infarction (AMI) and congestive cardiac failure (CHF), a physician measures patient’s serum level of cardiac biomarkers such as, troponin (cTn), creatine kinase-muscle/brain (CK-MB), and B-type natriuretic peptide (BNP) in count, to a number of diverse other tests including an electrocardiogram (ECG). In this study, we compare the serum level of cTnT, CK-MB and BNP in patients with AMI and CHF. We analyzed the results to assess if Troponin T can be used independently to differentiate AMI from CCF.

Materials and Method: In a retrospective cross-sectional study at Sri Ramachandra Medical Center, the serum level of cTnT, CK-MB and BNP were evaluated in patients who have had an acute myocardial infarction or congestive cardiac failure. The study group consisted of 100 male and female subjects in two groups, 50 subjects diagnosed with acute myocardial infarction and 50 patients diagnosed with congestive cardiac failure. Mean and Standard deviation for the two groups was taken and their p-value was calculated using the Mann Whitney U Test.

Results: Troponin T (cTnT) level was elevated in both Acute MI and CCF; however, the elevation was more in AMI patients (p=0.022) compared to CHF, but not very significant. Other two biomarkers, CK-MB and BNP, did not show any significant difference between the two groups.

Conclusion: Higher levels of CTnT may be seen in AMI as compared to CHF and is indicative of progressive cardiovascular disease.

Keywords: Troponin (cTn), CK-MB, B-type natriuretic peptide (BNP), Myocardial infarction, Congestive cardiac failure

Introduction

Acute myocardial infarction (AMI) is the medical term for heart attack, a life-threatening state occurring due to abrupt blood flow to the heart muscle leading to tissue damage ¹. The primary cause of blockage in the blood flow is coronary artery disease; it is a global health burden and the primary cause of morbidity and mortality ². Another cardiac disorder that affects the pumping power of the heart muscles is congestive heart failure (CHF), often referred to simply as heart failure ³.

Various diagnostic procedures have been utilized to diagnose the above-mentioned disorders. To diagnose a patient with a heart attack or failure of the heart muscle, a physician requires to measure the heartbeat, blood pressure and also run a number of different other tests¹⁴. An electrocardiogram (ECG) is done to compute heart’s electrical activity and blood tests primarily check for protein levels that are linked to heart damage such
as, troponin (cTn), creatine kinase-muscle/brain (CK-MB) and B-type natriuretic peptide (BNP). Estimation of biomarkers such as cTn, CK-MB, and BNP have an advantage over ECG since they can be estimated in the peripheral circulation even before the findings appear in ECG 5, 6, 7. Numerous other biomarkers have been used such as myoglobin, AST, LDH etc., and most of them are neither sensitive nor specific. Thus the situation requires adequate sensitivity and specificity 8, 9, 10.

This study was designed to evaluate levels of cTnT in patients with AMI and CHF, and it was then compared with CK-MB and BNP. We analyzed the results to assess if Troponin T can be used independently to differentiate AMI from CCF.

**Materials and Method**

**Ethical Approval:** This retrospective cross-sectional study was conducted at Sri Ramachandra Medical Center to evaluate the levels of CK-MB, cTnT and BNP in south Indian patients who have had an acute myocardial infarction or congestive cardiac failure. The study was accepted and designed by the Institutional Ethics Board (IEC), Sri Ramachandra Medical College and Research Institute. The study group consisted of 100 male and female subjects in two groups, 50 subjects diagnosed with acute myocardial infarction and 50 patients diagnosed with congestive cardiac failure.

**Inclusion Criteria:** Patients with a known case of acute myocardial infarction and congestive cardiac failure were included in this study. Patients with elevated levels of cardiac troponins, with either symptoms or ECG changes indicative of myocardial infarction/ischemia, were diagnosed for AMI. Patients with abnormal heart rhythms with echocardiogram changes indicative of congestive heart failure were diagnosed for CHF.

**Exclusion Criteria:** Exclusion criteria: People with chronic renal failure and malignancies were excluded.

**Laboratory Investigation**

**Measurement of Serum Cardiac Troponin I:** cTnI (ng/mL) was measured using the particle enhanced fluorescence immunoassay technique (i-CHROMA™ analyzer) 11. The test contains a cartridge of a two-site enzyme-linked immunosorbent assay (ELISA) for antibodies specific cTnI on an electrochemical sensor fabricated on a silicon chip. The plasma sample is run through the chip and brought into contact with the sensors which allow the enzyme conjugate to dissolve into the sample. The cTnI within the sample labeled with alkaline phosphatase is captured during an incubation period. The enzyme bound to the cleaves the substrate releasing an electrochemically detectable product is measured which is proportional to the concentration of cTnI within the sample.

**Estimation of Creatine kinase-MB isoenzyme (CK-MB):** CK-MB was estimated in the patient serum using the enzymatic immuno-inhibition test in Beckman Coulter AU analyzer for the quantitative determination of creatine kinase-MB isoenzyme (CK-MB). This is a modification of the IFCC method which contains an antibody binds to the M subunit of CK in the serum sample thereby inhibiting the activity of the M subunit and B subunit remains free to act on the substrate present in the reagent. During the process, the generated ATP is used to for simultaneous reduction of NADP to give NADPH. The rate of increase of absorbance at 340/660 nm due to the formation of NADPH is directly proportional to the activity of CK-MB in the sample. Beckman Coulter analyzers automatically compute the CK-MB activity of each sample.

**Estimation of B-type natriuretic peptide (BNP) BNP:** Patient plasma was collected for the measurement of BNP using the Triage BNP test in Beckman Coulter Immunoassay Systems (UniCel Dxi 800) for the in vitro. The test includes crescent immunoassay device which separates plasma from whole blood during run and plasma exposed to antibodies conjugated with fluorescence and flow through which bare captured on discreet zone to the analyte. The test device is used to perfume BNP analysis using Beckman Coulter Immunoassay Systems 12.

**Statistical Calculation:** Mean and Standard deviations for the two groups were taken and their p-value was calculated using the Mann Whitney U Test since the data did not follow normality and was randomly distributed, in which case the t-test assumptions do not work, creating the necessity for using Mann Whitney U test.

**Results**

Fifty blood samples each from AMI and CCF patients were collected and statistical analysis-mean and standard deviation along with their p-value of the three biomarkers were derived which are shown in Table 1.
Troponin T (cTnT) level was elevated in both Acute MI and CCF; however, the elevation was seen more in AMI patients (p=0.022) compared to CHF, but not very significant. The other two biomarkers CK-MB and BNP did not show any significant difference between the two groups, although the mean value was high in the CHF group.

Table 1: Mean and standard deviation along with their p-value of the three biomarkers

<table>
<thead>
<tr>
<th>Biochemical Parameter</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>‘p’ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troponin T</td>
<td>MI Group</td>
<td>50</td>
<td>416.3200</td>
<td>851.14296</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td>CCF group</td>
<td>50</td>
<td>361.3000</td>
<td>1085.69365</td>
<td></td>
</tr>
<tr>
<td>CK-MB</td>
<td>MI Group</td>
<td>50</td>
<td>30.4000</td>
<td>21.35129</td>
<td>0.796</td>
</tr>
<tr>
<td></td>
<td>CCF group</td>
<td>50</td>
<td>42.0000</td>
<td>81.34156</td>
<td></td>
</tr>
<tr>
<td>BNP</td>
<td>MI Group</td>
<td>50</td>
<td>1445.1400</td>
<td>1495.08172</td>
<td>0.216</td>
</tr>
<tr>
<td></td>
<td>CCF group</td>
<td>50</td>
<td>1603.1600</td>
<td>1283.61935</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

cTnI is a clinical significance biochemical cardiac marker used for the diagnosis of myocardial infarction. To be optimal diagnostic usefulness, a cardiac marker has to be specific for disease target, rapidly released and should persist for a sufficient time to provide a convenient diagnostic time window. There are many other clinical conditions in which an elevated troponin level without ischemic coronary artery disease is seen. In such conditions, the results might be confusing and a clinician does require an additional set of markers to differentiate the condition. Although, troponin is considered to be a marker of choice in aid of diagnosis of acute myocardial infarction (AMI). B-type natriuretic peptide (BNP) level is also prominent in AMI and is a quantitative biochemical marker related to the extent of the infraction, as seen in other study results 12, 13. In the CK-MB group, the mean difference is small and may have occurred by chance variation. In the BNP group, though the mean difference is significant, the standard deviation for the same is high. Thus, the p-value is not significant. A high value of CK-MB with the elevation of Troponin T is almost always associated with AMI. There also might be a slight increase in BNP levels in AMI. In patients with high values of BNP, elevation of Troponin T is seen in cases of congestive cardiac failure 14, 15. Sometimes, CK-MB is also elevated, which may not indicate CCF, but cardiac myopathies.

In this study, the analysis is done using the Mann Whitney U Test which is the non-parametric alternative test for independent sample t-test. Mann Whitney U is used to compare the mean of two tests, whether they are equal or not from a similar population. Unlike the other t-test, it does not require any assumption for normal distributions and at the same time, it is nearly as competent as the t-test on normal distributions. According to the Mann Whitney U test, if the p-value is less than 0.05, there is statistical significance to the value between the two groups. As Troponin T p value= 0.022, it implies that it can be used independently for the diagnosis of AMI since the mean for the AMI group is higher. This implies that the value of Troponin T has a statistically significant difference in MI and CCF.

Conclusion

The study demonstrates that Troponin T can be used as a more potent cardiac biomarker compared to BNP, to help in the diagnosis of most of the cardiac diseases including, acute myocardial infarction and congestive cardiac failure. It may also prove useful in assessing prognosis and designing therapy in such conditions. A confirmed diagnosis of AMI or CCF cannot be drawn from a single biomarker, but only from a combination of the three, along with clinical correlation. A major limitation of this study is that measurement of the markers was not evaluated during hospitalization and changes of the levels were not seen after interventional treatment. In addition, we did not have the coronary angiography for all the patients to confirm the diagnosis.

Conflict of Interest: Authors declare nothing to disclose

Source of Funding: None

Ethical Clearance: The study was accepted and designed by the Institutional Ethics Board (IEC), Sri Ramachandra Medical College and Research Institute.
REFERENCES


A Study on the Effect of Eight Weeks Exercise Training Protocol to Prevent Ankle and Knee Injuries among Basketball Players

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ABSTRACT

Background: The prevalent ratio of injuries in basketball influences the lower appendages, particularly, ankle and knee joint, and this is the real reason for missed long periods of training amid a season. Additionally, ankle and knee injuries can increase the risk factor of intermittent injuries. An exercise protocol is conceivably a critical preventative measure as it seemed to diminish the occurrence of ankle and knee injuries.

Objectives: To examine the impact of a structured theraband exercise protocol intended to reduce the rate of ankle and knee injuries in young basketball players.

Materials and Method: 48 male players aged 19-25 years; contributed in the study, 24 in experiment group; 24 players in the control group. The program is a modification of other prevention exercise protocol previously proven to be effective. All exercises in the present protocol are attuned so that a more progressive development in the exercise is accessible.

Intervention: A structured training protocol (thera-band exercise programme) to improve neuromuscular power, strength, and control and to reduce ankle and knee injuries.

Main Outcome Measure: The rate of injuries to the ankle or knee.

Results: During the season, 6 ankle and knee injuries occurred, 5 injuries in the control group; (2 injuries in training and 3 during matches) and 1 injury in the experiment group (0 injuries in training and 1 injury in matches). Rarer injured players were in the experiment group than in the control group.

Conclusion: Structured exercise training protocol of theraband exercises focusing on awareness and can successfully prevent ankle and injuries in young basketball players. Preventive training ought to hence be presented as a vital part of youth sports programmes.

Keywords: basketball, ankle, knee, exercise, prevention.

Introduction

To accomplish capability and elite execution, competitors are embraced extreme training at more youthful ages, taking an interest in complex games in a single season, and keeping training all through the whole year. Sporting activities, for example, basketball, handball, soccer, and volleyball are high-chance activities particularly for parallel ligament injuries of the lower leg joint complex. A large portion of the injuries which happen in basketball in the lower appendage. Both abuse (e.g. shin braces, stress fractures, patellar tendinopathy (PT), patellar femoral agony disorder (PFPS) and acute injuries (e.g. ACL injury and lower leg sprains. These injuries frequently result in a substantial time off for the injured players, regularly one week or more or five to six sessions. Reports from Scandinavia that sports injuries establish 10-19% of every single acute injury found in emergency organizations and the most well-known categories are ankle and knee injuries. Genuine knee injuries, for example, injuries to the ACL, are a developing reason for concern. The most elevated occurrence is found in young players playing rotating sports, for example, basketball, handball, and football. This implies injury event can put a stop to the competitor’s cooperation in his game for quite a while. This would already be able to happen at an early age and result in long-lasting imperative in-game support.
With the end goal to reduce short and long haul results, there is a requirement for sports injury prevention. A few creators exhort completing a preventive program to minimize the risk of ankle injury.\textsuperscript{20,21} The aim of this examination was to investigate the effectiveness of 8-week lower limb appendage effective exercise training protocol to prevent ankle and knee injuries in youthful basketball players.

**Methodology**

In our study, we recruited 24 subjects for each group (study and control) so that the sample was adequately powered and the participant number was increased to avoid too small a sample, in case any of the subjects abandoned the study. The total of 48 basketball male players, with their age ranging from 19 to 25 is selected from Department of physical education, Annamalai University, Tamil Nadu India.

The criteria to take an interest in this examination were to have been free from any lower appendage injury for no less than a half year, no history of lower appendage medical procedure, to be free of vestibular issue, to be correct footed, to join the pre-and post-test sessions and to have the capacity to incorporate and do the training protocol in their day by day schedule. The primary day, and before the beginning of the main test, the members’ anthropometric estimations were recorded to affirm that they satisfied all the vital conditions to be incorporated. Participants were put into either the control group or the experimental group is appeared in table 1.

**Training Protocol:** The control group contained 24 players who sustained their normal training routines. The experimental group contained also 24 players who executed a multi-station thera-band exercise protocol (box 1) that was designed in cooperation of Physiotherapist and coach of the Annamalai University. The first author, physiotherapist and the coach instructed the subjects in detail on performing the core assessment tests and supervised their 8-week exercise protocol to ensure the exercises were performed correctly.

| Table 1: Number of players participating in this study |
|----------------------------------|----------|
| **Experiment Group**  | **Control Group** |
| Total n = 24  | n = 24 |
| Dropouts n = 1  | n = 3 |
| Analyzed n = 23  | n = 21 |

It was performed 4 days in a week and comprised of six stations that were performed twice (shoeless) toward the start of the ordinary training routine (box 1).

**Box 1: Exercise training protocol to prevent knee and ankle Injuries**

**Warm-up exercises:** (30 seconds and three repetitions each)
1. Jogging end to end
2. Forward running with knee lifts and heel kicks
3. Sideways running with crossovers
4. Sideways running with arms lifted
5. Forward running with trunk rotations
6. Forward running with intermittent stops
7. Speed run

**Thera-Band exercises (Strength and Power)**
1. Hip Flexion, Extension, Adduction and Abduction (Standing)
2. Knee Flexion and Extension (Sitting)
3. Knee Flexion and Extension (Prone)
4. Lunge
5. Squat
6. Ankle Dorsi-flexion and Plantar-flexion
7. Ankle Inversion and Eversion

The exercise time and the intensity and trouble of the activities were expanded amid the season twice by minor changes for each station each week.

**Outcome Measures:** We characterized the essential result as an injury to the ankle and knee. An auxiliary result was characterized as an injury to the lower appendages. We additionally included auxiliary investigations of injuries in general (counting all injuries) and injuries to the upper appendage.

The number of injured players depended on information from individual players and the rate of injuries on outline information of injuries and exposures for the entire group. The examination researcher and a mentor who recorded injuries in groups, utilizing definitions and institutionalized injury questionnaire depicted in our before the study.\textsuperscript{22} The exploration researchers
and a physiotherapist were in contact with the mentors somewhere around consistently to record injured players and performance information. The mentors of the group receiving the test recorded consistence on an assigned frame as the quantity of injury prevention sessions, the period of every session in minutes, and the normal participation of the players (in percent).

**Statistical Methods:** We used the inverse of the difference between percentages of injured players in the two groups to calculate the number needed to treat to save one injury. We calculated exposures to training and matches and incidence of injury as described in our earlier study. We used ANOVA test to compare the two groups and activities (match, training). Relative risk is presented with 95% confidence intervals. We regarded two tailed P values ≤ 0.05 as significant.

**Results and Discussion**

Table 1 demonstrates the stream of players taking an interest in this examination. Players in the two groups were comparable in the distribution of age, height, mass and time of injured players (table 2). Each of the 24 (50%) in the control group used general exercises planned to prevent injuries. Additionally, 24 (50%) in the experimental group used explicit exercise and a training protocol (Thera-Band practices for ankle and knee) used to prevent injuries during the examination time frame. During the 8-week season, 13(27.1%) of the 48 players who got injured in this report and a total of 13 injuries. Among 13 players 4 players from the experimental group and 9 players from the control group. Of these, 8 (17%) were acute injuries and 5 (10%) were overuse injuries.

<table>
<thead>
<tr>
<th>Body Category</th>
<th>Experiment Group (n = 23)</th>
<th>Control Group (n = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle</td>
<td>0(0.00%)</td>
<td>2(9.5%)</td>
</tr>
<tr>
<td>Knee</td>
<td>1(4.35%)</td>
<td>3(14.28%)</td>
</tr>
<tr>
<td>Finger/wrist</td>
<td>1(4.35%)</td>
<td>2(9.5%)</td>
</tr>
<tr>
<td>Head</td>
<td>0(0.00%)</td>
<td>0(0.00%)</td>
</tr>
<tr>
<td>Low back</td>
<td>1(4.35%)</td>
<td>1(4.76%)</td>
</tr>
<tr>
<td>Shoulder/elbow</td>
<td>1(4.35%)</td>
<td>1(4.76%)</td>
</tr>
</tbody>
</table>

**Acute Injuries**

- Sprain 2(8.69%) 2(9.5%)
- Contusion 1(4.35%) 3(14.28%)
- Fracture 0(0.00%) 0(0.00%)
- Strain 0(0.00%) 0(0.00%)

**Overuse Injuries**

- Low leg pain 0(0.00%) 1(4.76%)
- Knee pain 0(0.00%) 1(4.76%)
- Low back pain 1(4.35%) 1(4.76%)
- Ankle pain 0(0.00%) 1(4.76%)

Table 3 shows the ratio of body category, acute, and abuse injuries of both experiment and control group. In experimental group it was found that 1(4.35%) of players got injuries in knee, finger/wrist, low back and shoulder/elbow and in control group 2(9.5%) got injuries in ankle and finger/wrist, 3 (14.28%) got knee injuries and 1(4.76%) players got injuries in low back and shoulder/elbow. Table 3 also displays the site of the most common body part injured and the type of acute and abuse injuries and the age of the injured players.

In experimental group, acute and abuse injuries was found 2(8.69%) sprain, 1(4.35%) contusion and low back pain respectively, and in control group 2(9.5%) sprain, 3(14.28%) contusion and 1(4.76%) low back pain, knee pain, low back pain, and ankle pain respectively.
Table 4: Objective to treat analysis. Values are numbers (percentages) of injured players

<table>
<thead>
<tr>
<th>Experiment Group (n = 23)</th>
<th>Control Group (n = 21)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Injuries</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Lower limb injuries</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Knee and Ankle Injuries</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Knee Injuries</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Ankle Injuries</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Upper limb injuries</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 4 shows the mean difference of experimental and control group with respect to injuries exposed that there was no significant difference located between experiment and control group with regard to all injuries, lower limb injuries, ankle, and knee injuries and upper limb injuries.

Further, it was found that in the experimental group there were only 4 injuries, 2 injuries in the lower limb (1 in ankle and knee) and 2 in the upper limb. More ever in control group were 9 injuries, 6 injuries in the lower limb (5 in knee and ankle) and 3 in the upper limb.

Table 5: Incidence of injuries during matches and training

<table>
<thead>
<tr>
<th>Experiment Group (n = 23)</th>
<th>Control Group (n = 21)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Injuries</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Match</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Training</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Knee and Ankle Injuries</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Match</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Training</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

In Table 5 shows the mean difference of experiment and control group with regard to match and training. It is discovered that there were 4 injuries in experiment group (3 injuries in the match and 1 injury in training) and 9 injuries in control group (7 injuries in match and 2 injuries in training). More ever there was 6 knee or ankle injuries happened, 5 injuries in the control group; (2 injuries in training and 3 injuries in the matches) and 1 injury in the experiment group (0 injuries in training and 1 injury in matches).

Effect of Prevention: There is not entirely difference were in the experimental group than in the control group for injuries by, and large, bring down appendage injuries, acute ankle, and knee injuries, and abuse knee and upper appendage injuries (table 4). The general difference in the frequency of match and training injuries was additionally not significant (table 5). The experimental group used exercise protocol to prevent injuries had a lower rate of injuries than the control group doing no preventive action.

The percentage of injuries in young basketball players using a structured exercise training protocol (thera-band exercises protocol) improved clinically and statistically, especially to decrease the rate of severe injuries to the ankle and knee. The reduction in the relative risk is not significant in this study. As far as we are aware, our study is the first amongst basketball younger players with a select sample size to show that ankle and knee injuries can be reduced and severe injuries have drawn further.

Conclusion

The present investigation shows that a preventive exercise training protocol performed 4 days in a week proposed significantly to improve awareness and reduced the frequency of ankle and knee injuries in selected basketball players. Although the selected were basketball players, it may be protected to assume that the program is also applicable to other sports or high-risk activities as team handball, volleyball, or soccer.

Acknowledgements

I am thankful to Dr. R. Gopinath, Professor and Head, Department of Physical Education, Annamalai University for providing me an opportunity to conduct this study and emphasis special thanks to my Guide Dr. K. Sreedhar and Physiotherapist for assisting in collecting data.

Ethical Clearance: The article has not been submitted for publication anywhere else after it has been published in journal nor is under consideration to be published again. Also, the Article does not violate any other copyright or any other third party rights.

Source of Funding: Self

Conflict of Interest: Nil
REFERENCES
Assessment of Dental Implant Displacement into Mandibular Medullary Bone Space using Cone Beam Computed Tomography (CBCT)–A Case Report and Literature Review

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ABSTRACT

Intraoral periapical radiography and panoramic radiography used to be indispensable tools for hard tissue analysis in dental implant planning. However, their inherent 2D limitations have ushered in an era of Cone Beam Computed Tomography (CBCT) for a volumetric holistic analysis. This case report depicts accidental displacement of implant into a mandibular medullary bone space with deficient bone density in an otherwise healthy individual and its subsequent surgical retrieval and prognosis. We wish to highlight the importance of CBCT as a mandatory pre-surgical tool for implant planning in all cases to prevent intraoperative adverse events, irrespective of their medical status.

Keywords: Implant displacement, medullary space, Cone Beam Computed Tomography

Introduction

With the advent of 3-dimensional imaging using Cone Beam Computed Tomography (CBCT), dental implant surgeries have become predictable, safer and have gained immense popularity as a definitive means of prosthetic rehabilitation. This tool helps us in accurate assessment of bone quality and quantity, helps rule out any bone pathology and in estimation of clearance to critical structures such as inferior alveolar nerve, maxillary sinus and nasal floor and buccal and lingual cortical plates. Further, this leads to a successful implant surgery by avoiding potential intra and postoperative complications such as haemorrhage, nerve damage, mandibular fractures, lack of implant stability, implant migration and implant displacement. Through this note, we intend to state the importance of CBCT as a necessary diagnostic pre-surgical tool for implant surgeries, even in systemically healthy individuals.

Case Report: A 27-year-old otherwise healthy male was posted for rehabilitative implant placement corresponding to edentulous left lower posterior teeth 36 and 37. Pre-operative panoramic radiograph taken for the assessment of proposed implant sites revealed an unaltered trabecular pattern and an adequate clearance from the crest of the residual alveolar ridge to the superior aspect of the inferior alveolar nerve canal. After achieving adequate anaesthesia, a crestal incision was made at the edentulous residual alveolar ridge and a muco-periosteal flap was raised. Drilling was done and the implants were placed at the intended sites. The drilling sequence was initiated for insertion of implants at two sites. Torqueing procedure of the implant at 37 region was uneventful. However, while attempting the same procedure on the implant in 36 region, it unexpectedly got dislodged from the intended placement site deeper into the marrow space and could not be located at the

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surgical area despite copious irrigation and suctioning. A panoramic radiograph was immediately taken to ascertain the location of the displaced implant. It revealed inferior displacement of the implant within the body of the mandible. The implant was vertically aligned, with its crest closely approximating the root apex of 35 and the apex in close approximation to the inferior alveolar nerve canal. Cone beam computed tomography (CBCT) was taken to clearly visualise the implant in the three orthogonal planes. It revealed the inferior displacement of implant within the medullary bone closely involving lingual cortical plate but not causing any thinning or perforation(Fig1). Additionally, significant trabecular porosity at the region of interest with a mean bone density of 168 Hounsfield Units (D4) was noted. Inferior alveolar nerve tracing revealed close involvement of the implant fixture to the buccally positioned canal as well as to the mental foramen. The situation was explained to the patient and informed consent was obtained. As we had already established large trabecular porosity within the mandibular corpus, and the fixture being movable and loose; therefore, the implant could not be removed by reverse torque. Therefore, the surgical removal of the implant was planned using the lateral decortication procedure. A bone window was created on the buccal cortex to obtain visual access to the implant fixture and retrieved taking care to avoid injury to the inferior alveolar nerve(Fig 2). In the immediate post-operative period, patient complained of numbness at left lower lip. Post-op recovery was uneventful. By 8 weeks, complete recovery was reported with him having regained sensation at lower lip.

![Fig. 1: CBCT-Displacement of Implant in medullary space](image1)

![Fig. 2: Surgical removal of implant](image2)
<table>
<thead>
<tr>
<th>Number</th>
<th>Reference</th>
<th>Age/gender</th>
<th>Relevant medical history</th>
<th>Direction of the displacement</th>
<th>Surgical approach</th>
<th>Neurologic complication</th>
<th>Postoperative course</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Thiesen et al (1990)</td>
<td>35/F</td>
<td>No</td>
<td>Centre</td>
<td>Crestal</td>
<td>No</td>
<td>Favourable</td>
</tr>
<tr>
<td>2.</td>
<td>Bayram (2011)</td>
<td>58/F</td>
<td>Osteoporosis</td>
<td>Displacement to mandibular lower border</td>
<td>Lateral</td>
<td>No</td>
<td>Favourable</td>
</tr>
<tr>
<td>3.</td>
<td>Doh et al (2011)</td>
<td>54/F</td>
<td>No</td>
<td>Displacement to middle of mandibular body</td>
<td>Crestal</td>
<td>Hypoesthesia</td>
<td>Hypoesthesia</td>
</tr>
<tr>
<td>4.</td>
<td>Lee et al (2013)</td>
<td>51/F</td>
<td>No</td>
<td>Displacement to mandibular lower border</td>
<td>Lateral</td>
<td>No</td>
<td>Favourable, implant re-insertion after 3 months</td>
</tr>
<tr>
<td>5.</td>
<td>Lee et al (2013)</td>
<td>60/F</td>
<td>Lingual</td>
<td>Disp. above IAN canal</td>
<td>Lateral</td>
<td>No</td>
<td>Favourable</td>
</tr>
<tr>
<td>6.</td>
<td>Lee et al (2013)</td>
<td>51/F</td>
<td>No</td>
<td>Displacement to mandibular lower border</td>
<td>Lateral</td>
<td>No</td>
<td>Favourable</td>
</tr>
<tr>
<td>8.</td>
<td>Oh et al (2016)</td>
<td>57/F</td>
<td>Osteoporosis</td>
<td>Displacement to mandibular lower border</td>
<td>Lateral</td>
<td>Hypoesthesia</td>
<td>Hypoesthesia</td>
</tr>
<tr>
<td>11.</td>
<td>Kim et al (2017)</td>
<td>68/F</td>
<td>No</td>
<td>Displacement to middle of mandibular body</td>
<td>Crestal</td>
<td>Hypoesthesia</td>
<td>Improved, but remained mild hypoesthesia</td>
</tr>
<tr>
<td>12.</td>
<td>Kim et al (2017)</td>
<td>59/F</td>
<td>No</td>
<td>Displacement to mandibular lower border</td>
<td>Lateral</td>
<td>Hypoesthesia</td>
<td>Improved, but remained mild hypoesthesia</td>
</tr>
<tr>
<td>13.</td>
<td>Kim et al (2017)</td>
<td>34/F</td>
<td>Yes</td>
<td>Displacement to mandibular lower border</td>
<td>Lateral</td>
<td>Hypoesthesia</td>
<td>Improved, but remained mild hypoesthesia</td>
</tr>
<tr>
<td>15.</td>
<td>Kim et al (2017)</td>
<td>67/M</td>
<td>No</td>
<td>Displacement to mandibular lower border</td>
<td>Lateral</td>
<td>Hypoesthesia</td>
<td>Improved, but remained mild hypoesthesia</td>
</tr>
<tr>
<td>16.</td>
<td>Current case</td>
<td>27/M</td>
<td>No</td>
<td>Displacement to middle of mandibular body</td>
<td>Lateral</td>
<td>Hypoesthesia</td>
<td>Complete recovery at 2month follow-up</td>
</tr>
</tbody>
</table>
Discussion

Displacement of implants during surgical procedures within the mandibular medullary spaces is not an unusual situation.\(^2,3\) This case, however, brings forth a scenario where an otherwise healthy individual had physiologically reduced bone density which led to an adverse iatrogenic event. Dental implant surgeries are gaining immense popularity for prosthodontic rehabilitation and its success depends on meticulous planning with the aid of a diagnostic technique capable of obtaining highly accurate alveolar and implant site measurements to assist with treatment and avoid damage to adjacent vital structures during surgery. Intra oral periapical radiographs and panoramic radiographs are the commonly used screening radiographs for implant planning. CBCT by means of its volumetric analysis provides a more precise estimate of hard tissue parameters compared to 2D images while emitting lower doses compared to other volumetric imaging modalities like Computed Tomography. Improved technological advancements in software applications like virtual implant planning further augment our precision and render the surgical procedure risk-free. In a developing country like India, financial considerations play an important role in limiting its usage as a mandatory presurgical tool for implant surgery. However, we must understand that the knowledge we gain well in advance to the procedure helps us in a better case selection, either by finding a means to address the imminent complications or by recommending alternative treatment regimens for rehabilitation. Table 1 depicts an overview of reported cases of mandibular medullary implant displacement in which CBCT was used after the event. The American Academy of Oral and Maxillofacial Radiology (AAOMR) in its position paper\(^4\) has recommended that CBCT be considered as the imaging modality of choice for preoperative cross-sectional imaging of potential implant sites. Jaju et al\(^5\) has emphasized that to further supplement our precision and minimize risks, implantologists should have three-dimensional (3D) information of bone volume and topography prior to implant placement. Loubele et al\(^6\) reported that both CBCT and CT yield submillimetre accuracy for linear measurements on an ex vivo specimen for implant measurements while CBCT outscores CT by being more affordable while ensuring lesser tissue irradiation. It becomes imperative that clinicians should consider using CBCT, an emerging gold standard\(^7,8\) in implant imaging in addition to 2D radiographs, if they believe that the additional anatomic information is necessary to correctly diagnose, plan and implement treatment in the safest manner possible, and inform the patient about its merits prior to surgery.

Conclusion

We advocate routine use of CBCT as an imaging modality for Pre-surgical implant planning to provide accurate assessment of bone quality and quantity and potential risk assessment, thus enabling us to avoid inadvertent complications during and after the implant placement as in the present case.

Conflict of Interest: The authors hereby declare that there are no conflict of interest and all authors have made substantive contribution to this manuscript and all have reviewed the final paper prior to its submission.

Source of Funding: NIL

Ethical Clearance: Ethical Clearance-Consent was taken.

REFERENCES


Screening of Leukemia from Microscopic Images of Blood Smear

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ABSTRACT

Leukemia, also called blood cancer is very common in medical practices. Acute lymphoid leukemia (ALL) and acute myeloid leukemia (AML) are the types of blood cancer that affect the bone, bone marrow, lymphatic system and are major contributors to cancer deaths. ALL is the most common type of leukemia and it is more predominant in children and young adults. As the number of leukemia cases increases, it leads to a delay in early diagnosis and treatment of the disease.

The present method for diagnosis includes a manual examination of blood smear by pathologists. Changes in the white blood cells can be an indicator of the nature and severity of the disease. For further classification of the type of leukemia, bone marrow biopsy is done. These manual processes are costly, complex, time-consuming and mostly depends on the operator’s ability. Hence, a need for automation arises which will be able to enhance and accelerate the diagnosis process. This paper provides a survey of different types of methodology which can be used to detect leukemia using image processing. These methods differ on the different types of image segmentation and feature extraction process employed by them. The methods are then compared by checking their efficiency and accuracy in differentiating and classifying the different leukemia cells.

Keywords: Leukemia, Image Processing, digital pathology, Blood Cells

Introduction

Pathology is a medical field concerned with the study and diagnosis of diseases. A microscopic slide is made of cells from the diseased body part, which is examined under a microscope. This has remained unchanged for a long time, while there have been many technological advancements in other fields. The introduction of information technology has helped in digitizing many fields in healthcare like radiology. However, with the advent of virtual microscopy, the transition process to digital pathology has been initiated.

Digital pathology has shown advantages over the traditional anatomic pathology. After the slides are digitized, algorithms can be developed to automate the counting of cells and structures or to classify the structures. This increases the accuracy of the diagnoses and also reduces human error. Also, digital slides are easy to share (tele-pathology) compared to physical slides [1]. But there are a few technological challenges too. The major one is image size. A normal digital slide contains around 20 billion pixels [2]. The size of such an image will be from a few hundred megabytes to several gigabytes. Due to its huge size, storing of images is difficult as a single scanning system may produce hundreds of images in a day. Images are usually stored in a centralized server and can be viewed by pathologists remotely over the network. Larger slide images take a longer time to transfer which may tie the system during the transfer. Also, interruptions in the connectivity may cause the data transfer to fail [2].

Leukemia is a group of cancer that originate at the blood marrow which is the site for blood cell production. Leukemia occurs when there is a build-up of blast cells, blood cells that are not completely matured. As the number of blast cells increases in the bone marrow, they...
spill out into the blood vessels which leads to an increase in the WBC count leading to the decrease in normal blood cell count. In a normal person, blast cells contribute only 1-2% of the total blood volume. When their numbers go above 20%, then it is termed as leukemia [3]. There are four major types of leukemia which are most common - acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL) and chronic myeloid leukemia (CML). Apart from these, there are more, less common subtypes.

In 2018, till now 437,033 people have been diagnosed with leukemia[4]. In children, it is the most common type of cancer with three-quarters of leukemia cases are the acute lymphoblastic type. In adults, AML and CLL are most common. Leukemia is diagnosed by checking blood smears under a microscope. It’s a manual procedure which is time-consuming and there are also chances of human error. For further confirmation and detecting the type of leukemia, the person has to go for a bone marrow biopsy, which is a painful procedure [4].

**Method**

The various important stages of computerized screening of digital blood information are shown in figure 1. This stage basically focusses on the extraction of good features from the acquired microscopic information of the blood smear. This, in turn, helps in dimension reduction of data. The trained classifiers recognize the classes of interest.

The images can be obtained by an optical microscope. A camera will be mounted on the eyepiece of the microscope. Then the operator will take images of the slides. The typical microscopic image of acquired from blood smear through the microscopic setup is shown in figure 2. Shown in Figure 2 (a) is a sample with an Acute Lymphoblastic Leukemia, whereas figure 2(b) is a normal blood sample [5].

![Fig. 1: Leukemia detection stages in Image Processing](image)

![Fig 2: Microscopic image of (a) Acute Lymphoblastic Leukemia (b) Normal blood sample](image)
Literature

The technique to detect leukemia through images of blood smear can be divided into the following stages: Image Segmentation, Feature Extraction and Classification. It is the process of partitioning a digital image into multiple segments so as to change the image into a simpler form. The segments formed will have certain common characteristics. Its goal is to extract information from an input image. The various types of image segmentation used in the literature that includes methods such as clustering or thresholding. Feature Extraction is a technique of redefining a large data set into certain features which have smaller dimensions. They are classified into three groups, colour, texture and geometrical features. The classifier uses the set of features and points out the difference between cancerous and non-cancerous cells. The goal is to detect abnormal WBC. It can also be used to further classify the cells into the subtypes of leukemia. The choice of the classifier depends on the set of features extracted from the dataset.

Agaian et al. (2014) converted the images into CEILAB and then segmented them using the k-means clustering algorithm. After features extraction, two sets of images are created. LBP (Local Binary Pattern) is employed on one set while it is not employed on another set. Support vector machine (SVM) is used to classify the cells. When LBP is not applied, the performance of the method is 70% whereas when LBP is applied, the performance increases to 93%.

Van-Nahn et al. (2016) used CMYK and used Otsu’s threshold method for image segmentation. Of the leukemia cells. This system gives an accuracy of 82.9%.

Shankar et al. (2017) converted the images into CMYK. The background is first removed by Zack Algorithm. Using the roundness ratio, the grouped and ungrouped lymphoblasts are separated. Grouped cells are separated by applying the watershed algorithm. Out of the 255 lymphoblasts that were given as inputs, the system is able to identify 245 cells.

Bhattacharjee et al. (2015) converted the images into grayscale. Binary images obtained by segmentation are used to extract the morphological features. Gaussian mixture modelling (GMM) and Binary Search Tree are the two classifiers used. The algorithm is able to differentiate between normal and blast cells with an accuracy of 95.56%.

Mohapatra et al. (2014) used colour segmentation in CIELAB. Haar wavelet-based and Haralicks feature based are used to extract the features. An ensemble-based classifier system is used for classification. K-nearest neighbour (KNN), Multilayer Perceptron (MLP) and SVM are used to classify. Sensitivity and accuracy of the proposed system are greater than 90%.

Rawat et al. (2017) extracted the features from each cell. The first classifier detects the cancerous cells while the second one is used to classify ALL cells into its subtypes and the average accuracy is found to be 97.6%.

Moradi Amin et al. (2016) converted the images into HSV. Fuzzy C-means clustering is used for image segmentation and then features are extracted. Features are extracted from each cell. The designed SVM had an accuracy of 97.53%.

Rawat et al. (2017) converted the images into greyscale. A generic algorithm is used to identify relevant features. SVM is used for classification. The accuracy obtained for classification of leukemia cells is 99.5%, for ALC subtypes it is 97.1% and for AMC subtypes it is 98.5%.

Vishwanath (2015) used images from ALL-IDB Database. Fuzzy C means is used to differentiate leukemia cells from normal cells. The algorithm provides an accuracy of 98%.

Sahlool et al. (2018) converted the images into CMYK. Social spider optimization algorithm is used to select particular features from the cells for better classification. Knn, SVM, NB-G and NB-K are used for classification. The system has a sensitivity of 100% with an accuracy of 99.23%.

Moshavash et al. (2018) used the distance transform and watershed algorithm to separate adjacent leucocytes. Features are extracted from the segmented images using two ensemble classifiers and the average accuracy obtained is 90.48%.

Madhloom et al. (2011) used the HSV colour space. They extracted two bands from the images, saturation and hue, and converted them into a binary image. The lymphoblasts are extracted using the shape features and it had an accuracy of 90-95%.

Khashman et al. (2013) used Otsu’s thresholding and the back propagation method for classification. Three learning schemes (LS) are developed to optimize neural model training. LS-1 achieved a better accuracy rate of 90%.
Mishra et al. (2017) converted the images into CIELab and used Marker-based watershed segmentation for separating grouped and overlapping objects. DCT is used for feature extraction and SVM for classification. The proposed method gives an accuracy of 89.76%.

Nimesh et al. (2015) used K-means clustering and Zack algorithm for image segmentation. Cseke’s observation is used to separate out nucleus and cytoplasm. The SVM classifier had an accuracy of 93.57%.

Karima et al. (2018) proposed a computer-aided system with a subsystem for WBC counting. Grouped lymphocytes are separated using a deep learning approach with RBM. A set of 52 features are extracted. Three types of multiple-classifiers (MCA) are used for classification. Overall WBC counting accuracy of the method was 97.8%.

Kaur et al. (2018) used Otsu’s method for image segmentation. Features are then extracted by Independent component analysis (ICA). Feed Forward neural network is used and achieved an accuracy of 95.89%.

Kumar et al. (2018) proposed a method with K-means, texture-based and colour-based segmentation. The images are then classified using Naïve Bayes and kNN classifiers and had an accuracy of 92.8%.

Mishra et al. (2018) converted the images into CEItab. They used Otsu’s thresholding method for leucocyte identification. To separate out the grouped lymphocytes, they calculated the roundness ratio. SVM is used for classification and recorded an accuracy of 96.97%.

In the feature extraction stage, features are classified into three groups; colour, texture and geometrical features. The accuracy of the approach is affected by the number of features used. In the classification stage, SVM, GMM, Binary Search Tree are some of the classifiers used. Accuracy rate is high in SVM classifier based approaches, which was also the most widely used one. Accuracy also increased when an ensemble-classifier was used. However, the classification stage is highly dependent on the image segmentation and feature extraction stages.

This paper presents an overview of the various approaches proposed and studies conducted on leukemia detection. An automated process can be generated using image processing which can speed up leukemia diagnosis. This will also ensure better and faster treatment of the patients. As most of the studies focused only on ALL, further research can include both AML and ALL.

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Source of Funding: Self

Ethical Clearance: Review article, no data processing.

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5. Morteza MoradiAmin, Ahmad Memari, Nasser Samadzadehaghdam, Saeed Kermani and Ardeshr Talebi, “Computer aided detection and classification of acute lymphoblastic Leukemia cell subtypes based on microscopic image


Relation between ARV and Birth Defects

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ABSTRACT

Background: Two components are considered in deciding the adverse effect on fetal development in pregnant mother with HIV infection. One, effect of HIV infection on fetus and second, effect of antiretroviral treatment (ARV). The major benefit of antiretroviral treatment (ARV) during pregnancy is prevention of mother to child transmission (MTCT) of HIV infection. The combination of zidovudine and lamivudine and lopinavir/ritonavir is one of the most used ART regimens for prevention of mother-to-child-transmission. At the same time there are concern related to its effect on adverse outcome of birth outcome. There is no clear supporting data but results shows conflicting conclusion on effect of antiretroviral treatment (ARV).

Methodology: hospital based prospective study was carried out at tertiary care centre, Krishna Hospital, Karad. Inclusive criteria was, Mothers who are diagnosed to have congenital birth defected fetus through antenatal examinations, delivered baby with diagnoses of congenital malformation, congenital malformed admitted neonates at Tertiary care hospital or came for reference services.

Results: Total 75136 babies were observed in pediatric outpatient department, 4092 babies in pediatric ward and 774 patients in Neonatal Intensive Care Unit. Total, 283 mothers were identified with birth defect. Among these, only 3 (1.1%) mothers gave information that they used ARV during pregnancy.

Conclusion: At the moment, few studies are available to determine the role of these drugs alone or associated with other ART in inducing birth defects. Very little is known about the mechanism of long term exposure to different ART regimens and the potential effect of birth-defect induction. Majority of HIV-1 infections in children have been reduced by 48% between 2009 and 2014 in 21 African priority countries due to ART coverage. Two components are considered in deciding the adverse effect on fetal development in pregnant mother with HIV infection. One, effect of HIV infection on fetus and second, effect of antiretroviral treatment (ARV). The major benefit of antiretroviral treatment (ARV) during pregnancy is prevention of mother to child transmission (MTCT) of HIV infection. The combination of zidovudine and lamivudine and lopinavir/ritonavir is one of the most used ART regimens for prevention of mother-to-child-transmission. At the same time there are concern related to its effect on adverse outcome of birth outcome. There is no clear supporting data but results shows conflicting conclusion on effect of antiretroviral treatment (ARV). Very little is known about the mechanism of long term exposure to different ART regimens and the potential effect of birth-defect induction. Majority of

Keywords: birth defects, Anti retroviral (ARV) therapy, relation
the pregnancies in women on ART might be unplanned pregnancies due to lack to effective contraception\textsuperscript{7}, \textsuperscript{8}, and \textsuperscript{9}.

According to the world health guidelines in 2010 two options were included, both of which should start earlier in pregnancy: at 14 weeks or as soon as possible. Worldwide, zidovudine /lamivudine with a non-nucleoside reverse-transcriptase inhibitor (NNRTI) or a protease inhibitor (PI) is the eligible combination regimen in ART-naive pregnant women. The history and evolution of the infection should be taken into account, as should whether the treatment is indicated for own health or only for MTCT, the presence of co-morbidities, and access and drug availability. Teratogenic effect has seen first trimester (up to and including 12 gestational weeks) as germ-layer formation and organogenesis occur during this period to teratogens.

**Methodology**

This hospital based prospective study was carried out at tertiary care centre, Krishna Hospital, attached to Krishna Institute of Medical Sciences “Deemed to Be University”, Karad Maharashtra state, India. Data was collected with the aim to evaluate the prevalence and risk factors of congenital malformation which was for the PhD degree. Apart from gathered data, part of information on ARV used during pregnancy were segregated and analyzed with systemic review. Inclusive criteria was, Mothers who are diagnosed to have congenital birth defected fetus through antenatal examinations, delivered baby with diagnoses of congenital malformation, congenital malformed admitted neonates at Tertiary care hospital or came for reference services were assessed from September 2016 to August 2017.

**Results**

Total 75136 babies were observed in pediatric outpatient department, 4092 babies in pediatric ward and 774 patients in Neonatal Intensive Care Unit. Total, 283 mothers were identified with birth defect. Among these, only 3 (1.1%) mothers gave information that they used ARV during pregnancy.

In the present study, researchers have gathered the data from Pediatric unit and Maternity unit. Pediatric unit included pediatric outpatient department, pediatric ward and Neonatal Intensive Care Unit where 80002 patients were assessed. Prevalence is noted maximum in the Neonatal Intensive Care Unit 41 (5.3%), thereafter in Pediatric Ward 14 (0.3%), and in pediatric Outpatient Department 45 (1%). Maternity unit included Maternity Outpatient Department, Maternity ward which also included labor room. In the Maternity Outpatient Department 50856 patients were visited in that 131 patients had the diagnosis of having congenital malformation fetus contributing to 0.3%. Whereas maternity ward had 3847 patients among those 52 (1.4%) had delivered congenital malformed babies. In our study considering the prevalence with number of birth, it is 1.4% and calculating with number of neonates admitted its prevalence rate is 5.3%. Overall in the hospital the prevalence noted is 0.2%.

**Table 1: Socio Demographic Variable of the Mothers**

<table>
<thead>
<tr>
<th>Demographic Variables</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maternal Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 20 Year</td>
<td>5</td>
<td>1.70</td>
</tr>
<tr>
<td>20-25 Year</td>
<td>116</td>
<td>39.46</td>
</tr>
<tr>
<td>25-30 Year</td>
<td>64</td>
<td>21.77</td>
</tr>
<tr>
<td>30-35 Year</td>
<td>53</td>
<td>18.03</td>
</tr>
<tr>
<td>Above 35 Year</td>
<td>45</td>
<td>15.31</td>
</tr>
<tr>
<td><strong>Gestational Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 Week</td>
<td>11</td>
<td>3.89</td>
</tr>
<tr>
<td>13-20 Week</td>
<td>45</td>
<td>15.90</td>
</tr>
<tr>
<td>21-28 Week</td>
<td>33</td>
<td>11.66</td>
</tr>
<tr>
<td>29-35 Weeks</td>
<td>68</td>
<td>24.03</td>
</tr>
<tr>
<td>36 Weeks</td>
<td>126</td>
<td>44.52</td>
</tr>
<tr>
<td><strong>Birth Weight of Baby</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less Than 1500</td>
<td>97</td>
<td>34.28</td>
</tr>
<tr>
<td>1500-1999</td>
<td>58</td>
<td>20.49</td>
</tr>
<tr>
<td>2000-2499</td>
<td>59</td>
<td>20.84</td>
</tr>
<tr>
<td>2500-3000</td>
<td>60</td>
<td>21.20</td>
</tr>
<tr>
<td>Above 3000</td>
<td>9</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Gender of congenital malformed babies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>180</td>
<td>63.60</td>
</tr>
<tr>
<td>Female</td>
<td>99</td>
<td>34.98</td>
</tr>
<tr>
<td>Ambiguous</td>
<td>4</td>
<td>1.41</td>
</tr>
<tr>
<td>Missing/Unknown</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Outcome of Birth</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live Birth</td>
<td>244</td>
<td>86.22</td>
</tr>
<tr>
<td>Still Birth</td>
<td>10</td>
<td>3.53</td>
</tr>
<tr>
<td>Elective Termination of Pregnancy</td>
<td>29</td>
<td>10.25</td>
</tr>
</tbody>
</table>


Sociodemographic Variables: The above table shows socio demographic variables of the mothers of congenital malformation. In this study, male babies were more affected with malformations. Table explicit that maximum congenital malformed babies were Male 180 (63.60%), followed by Female 99 (34.98%), Ambiguous 4 (1.41%) and Missing/Unknown is 0.

Outcome of Birth of congenital malformed babies results shows that maximum 244 (86.22%) were Live Birth followed by 10 (3.53%) Still Birth and that of Elective Termination of Pregnancy were 29 (10.25%).

As per Gestational Age is concerned less than 12 Week gestational aged mother were 11 (4%), 13-20 Week gestational aged mother were 45 (16%), 21-28 Week gestational aged mother were 33 (12%), 29-35 Weeks gestational aged mother were 8 (24 %), and maximum mothers belongs to 36 Weeks of gestational age 126 (45%).

Birth Weight of Baby shows that maximum, 97 (34.28%) babies belongs to less than 1500grams, between 1500gm -1999gm were 58 (20.49%), between 2000 -2499 grams were 59 (20.84%), between 2500-3000grms were 60 (21.20%) and Above 3000grams were 9 (3.2%) babies.

Considering the age of the mother maximum 116 (39.46%), samples belongs to 20-25 Years groups, and that of Below 20 Year 5 (1.70%), between 25 to 30 Year 64 (21.77%), between 30 to 35 Years 53 (18.03%) and Above 35 Years of aged mother were 45 (15.31%).

Results related to ARVs during Pregnancy and birth defects:

<table>
<thead>
<tr>
<th>ARVs During Pregnancy</th>
<th>Total birth defect</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>280</td>
<td>98.9</td>
</tr>
<tr>
<td>Yes</td>
<td>3 (nervous system defect- 01) (musculoskeletal system- 2)</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Association of Congenital Malformation with Use of ARV during pregnancy

<table>
<thead>
<tr>
<th>System of congenital malformation</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital malformations of the nervous system</td>
<td>61</td>
<td>2</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Congenital malformations of eye, ear, face and neck</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Congenital malformations of the circulatory system</td>
<td>57</td>
<td></td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Congenital malformations of the respiratory system</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Cleft lip and cleft palate</td>
<td>29</td>
<td></td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Other congenital malformations of the digestive system</td>
<td>23</td>
<td></td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Congenital malformations of genital organs</td>
<td>19</td>
<td></td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Congenital malformations of the urinary system</td>
<td>21</td>
<td></td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Congenital malformations and deformations of the musculoskeletal system</td>
<td>46</td>
<td></td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Other congenital malformations</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chromosomal abnormalities, not elsewhere classified</td>
<td>15</td>
<td></td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

Total, 283 mothers were identified with birth defect. Among these, only 3 (1.1%) mothers gave information that they used ARV during pregnancy.

Discussion

There are differences among the various studies of congenital anomalies in children exposed to anti retro viral in utero that may account for the varying prevalence rates reported. Congenital anomalies may be under-reported in some of the studies. Differential ascertainment across the studies may explain differences in prevalence. Our results, 1% is low compared with previous study reports. Previous result show that the prevalence of congenital anomalies among infants with in utero exposure to ARVs was 2.9% for the Antiretroviral Pregnancy Registry, 12 2.8–3.1% for the National Study of HIV in Pregnancy and Childhood in the United Kingdom and Ireland,13 and 3.56% for the Women and Infants Transmission Study.14 Even lower prevalence of congenital anomalies has been reported from the European Collaborative Study (1.6%) 15. However, other studies of HIV-infected women and their infants have documented higher rates of congenital anomalies16,16. Study results from US and UK reported prevalence ranging from 2.8% to 5.5% 17-22. Controversial to it, There are many studies which reported that no
relation between congenital malformation and exposure to ARV10,23,24. Some of the studies shows that, Either zidovudine or lamivudine, use of monotherapy, dual therapy are not found any relation with malformation in US25,26, Europe27,28,29 and Africa30.

**Summary:** The role of long-term exposure to different ART regimens and the potential effect of birth-defect induction in pregnancy are not well known30. Most of the largest and expressive data comes from retrospective, prospective, and case-report studies carried out in developed countries and could be not sufficiently representative of pregnant women living in developing country like India. At the moment, few studies are available to determine the role of these drugs alone or associated with other ART in inducing birth defects31. Further in depth research is required in this aspect.

**Conflict of Interest:** No Conflict of interest

**Source of Funding:** Self

**Ethical Clearance:** The study was initiated after approval of the Institutional Ethics Committee of Krishna Institute of Medical Sciences Deemed University’s.

**REFERENCES**


Does Maternal Diseases and Treatment Acts as Risk Factors for Birth Defect?

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Krishna Institute of Nursing Sciences, Karad

ABSTRACT

Lack of antenatal check up, inability to access health care facilities in rural area, inadequate knowledge about pregnancy care are major contributing factors for developing complication of disease and in terms causative factors for birth defect.

Methodology: Mothers who are diagnosed to have congenital birth defected fetus through antenatal examinations, delivered baby with diagnoses of congenital malformation, congenital malformed admitted neonates at Tertiary care hospital or came for reference services were assessed from September 2016 to August 2017.

Results: Out of 283 mothers who had congenital malformed babies, Total 239 (85%) mother had no history of any chronic disease but 44 (15%) pregnant woman diagnosed with chronic disorders. Among these 44 pregnant woman, 11 (4%) mothers were diabetic, 15 (5%) were reported to have thyroid disorders 9 (3%) woman were had hypertension, 3(1%) woman know to have seizures and 6 (2%) woman stated that they took medication for minor disorder which could not be noted as there was no records with mothers.

Conclusion: Chronic disorders before and early pregnancy may play a role in the etiology of major birth defects; however, more research is needed to unravel which factors are involved in the pathophysiological mechanisms that may lead to birth defects.

Keywords: Maternal Diseases, Treatment, Risk Factors, Birth Defect.

Introduction

With changing environmental and socio economical background, antenatal mothers are more prone to have chronic diseases that could adversely affect both mother and child. Congenital malformations otherwise called birth defect are due to many causes which are categorized into modifiable and non modifiable. The strongest and most notable risk factors, such as age of mother and family history of malformations (Genetic predisposition) are usually not modifiable. Many recent reviews shows there are number of modifiable factors which could be controlled to avoid risk for developing malformations such as infection, obesity, altered blood sugar level, exposing to radiations, smoking, using illegal drugs, and drinking alcohol while pregnant and stress. 70% of congenital malformations can be prevented by appropriate use of Community genetic services¹. Pregnant woman are at risk for developing many of the diseases, some may be identified and some may be missed. 8% of pregnant woman’s take some form medications for chronic disorders during pregnancy². Early identification and treatment of any physiological variation during pregnancies will help to prevent birth defects.

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Methodology

Mothers who are diagnosed to have congenital birth defected fetus and admitted neonates with congenital malformation were assessed from September 2016 to August 2017. Total 75136 babies were observed in pediatric outpatient department, 4092 babies in pediatric ward and 774 patients in Neonatal Intensive Care Unit. Prevalence is noted maximum in the Neonatal Intensive Care Unit 41 (5.3%), thereafter in Pediatric Ward 14 (0.3%), and in pediatric Outpatient Department 45 (1%). In the Maternity Outpatient Department 50856 patients were visited in that 131 patients had the diagnosis of having congenital malformation fetus contributing to 0.3% of prevalence. Whereas maternity ward had 3847 patients among those 52 (1.4%) had delivered congenital malformed babies.

Results

Table 1: Socio Demographic Variable of the Mothers

<table>
<thead>
<tr>
<th>Demographic variables</th>
<th>Frequency F</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 20 Year</td>
<td>5</td>
<td>1.70</td>
</tr>
<tr>
<td>20-25 Year</td>
<td>116</td>
<td>39.46</td>
</tr>
<tr>
<td>25-30 Year</td>
<td>64</td>
<td>21.77</td>
</tr>
<tr>
<td>30-35 Year</td>
<td>53</td>
<td>18.03</td>
</tr>
<tr>
<td>Above 35 Year</td>
<td>45</td>
<td>15.31</td>
</tr>
<tr>
<td>Gestational Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 Week</td>
<td>11</td>
<td>3.89</td>
</tr>
<tr>
<td>13-20 Week</td>
<td>45</td>
<td>15.90</td>
</tr>
<tr>
<td>21-28 Week</td>
<td>33</td>
<td>11.66</td>
</tr>
<tr>
<td>29-35 Weeks</td>
<td>68</td>
<td>24.03</td>
</tr>
<tr>
<td>36 Weeks</td>
<td>126</td>
<td>44.52</td>
</tr>
</tbody>
</table>

Table 1 conted...

<table>
<thead>
<tr>
<th>Birth Weight of Baby</th>
<th>Less Than 1500</th>
<th>1500-1999</th>
<th>2000-2499</th>
<th>2500-3000</th>
<th>Above 3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency F</td>
<td>97</td>
<td>58</td>
<td>59</td>
<td>60</td>
<td>9</td>
</tr>
<tr>
<td>Percentage %</td>
<td>34.28</td>
<td>20.49</td>
<td>20.84</td>
<td>21.20</td>
<td>3.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender of congenital malformed babies</th>
<th>Male</th>
<th>Female</th>
<th>Ambiguous</th>
<th>Missing/Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency F</td>
<td>180</td>
<td>99</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Percentage %</td>
<td>63.60</td>
<td>34.98</td>
<td>1.41</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 2: Congenital Malformation with History of Maternal Chronic Disease

<table>
<thead>
<tr>
<th>System of Congenital Malformation</th>
<th>No</th>
<th>%</th>
<th>Yes</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nervous system</td>
<td>56</td>
<td>20%</td>
<td>7</td>
<td>2%</td>
<td>63</td>
<td>22%</td>
</tr>
<tr>
<td>Eye, ear, face and neck</td>
<td>2</td>
<td>1%</td>
<td>0.5%</td>
<td>0%</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Circulatory system</td>
<td>47</td>
<td>17%</td>
<td>9</td>
<td>3%</td>
<td>57</td>
<td>20%</td>
</tr>
<tr>
<td>Respiratory system</td>
<td>4</td>
<td>1%</td>
<td>1</td>
<td>0%</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>Cleft lip and cleft palate</td>
<td>24</td>
<td>8%</td>
<td>5</td>
<td>2%</td>
<td>29</td>
<td>10%</td>
</tr>
<tr>
<td>Digestive system</td>
<td>16</td>
<td>6%</td>
<td>7</td>
<td>2%</td>
<td>23</td>
<td>8%</td>
</tr>
</tbody>
</table>

Sociodemographic Variables: In this study, maximum congenital malformed babies were Male 180 (63.60%), followed by Female 99 (34.98%). Outcome of Birth of congenital malformed babies results shows that maximum 244 (86.22%) were Live Birth. As per Gestational Age is concerned less than 12 Week gestational aged mother were 11 (4%), 13-20 Week gestational aged mother were 45 (16%), 21-28 Week gestational aged mother were 33 (12%), 29-35 Weeks gestational aged mother were 8 (24%), and maximum mothers belongs to 36 Weeks of gestational age 126 (45%). Birth Weight of Baby shows that maximum, 97 (34.28%) babies belongs to less than 1500 grams, between 1500gm -1999gm were 58 (20.49%), between 2000 -2499 grams were 59 (20.84%), between 2500-3000grms were 60 (21.20%) and Above 3000grams were 9 (3.2%) babies. Considering the age of the mother maximum 116 (39.46%), samples belongs to 20-25 Years groups, and that of Below 20 Year 5 (1.70%), between 25 to 30 Year 64 (21.77%), between 30 to 35 Years 53 (18.03%) and Above 35 Years of aged mother were 45 (15.31%).
Table 2 conted…

<table>
<thead>
<tr>
<th>Genital organs</th>
<th>13</th>
<th>5%</th>
<th>6</th>
<th>2%</th>
<th>19</th>
<th>7%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary system</td>
<td>19</td>
<td>7%</td>
<td>3</td>
<td>1%</td>
<td>21</td>
<td>7%</td>
</tr>
<tr>
<td>Musculoskeletal system</td>
<td>46</td>
<td>16%</td>
<td>1</td>
<td>0%</td>
<td>47</td>
<td>17%</td>
</tr>
<tr>
<td>Other congenital malformations</td>
<td>1</td>
<td>0%</td>
<td>1</td>
<td>0%</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Chromosomal abnormalities, not elsewhere classified</td>
<td>11</td>
<td>4%</td>
<td>4</td>
<td>1%</td>
<td>15</td>
<td>5%</td>
</tr>
</tbody>
</table>

Total 239 84% 44 16% 283 100%

Above table shows that mother who diagnosed to have chronic diseases during or before pregnancy gave birth to, Congenital malformations of the nervous system 7 (2%), circulatory system 9 (3%), respiratory system 1 (0.5%), Cleft lip and cleft palate 5 (2%), Digestive system 7 (2%), Genital organs 6 (2%), urinary system 3 (1%), musculoskeletal system 1 (0.5%), Other congenital malformations 1 (0.5%) and Chromosomal abnormalities, not elsewhere classified 4 (1%).

Out of 283 mothers who had congenital malformed babies, Total 239 (85%) mother had no history of any chronic disease but 44 (15%) pregnant woman diagnosed with chronic disorders. Among these 44 pregnant woman, 11 (4 %) mothers were diabetic, 15 (5 %) were reported to have thyroid disorders 9 (3 %) woman were had hypertension, 3(1 %) woman know to have seizures and 6 (2 %) woman stated that they took medication for minor disorders which could not be noted as there was no records with mothers. These mothers regularly took Oral Hypoglycemic Agents, antihypertensive, anti seizure drugs and medications for thyroid disorders.

Discussion

Since many decades researchers are trying to search relation between mother’s glycemic level and birth defect. Despite better control sugar levels throughout pregnancy the malformed babies rate does not show any decline. In this study also we found that maternal diabetes and thyroid disorders are the important risk factors for malformation. Many review supported the cause for malformation could be diabetes such as studies by Mills J1, Molsted P4, Lazalde B5, Kucera J6, Chung CS7, Farquhar J8, Karlson K9, Day R10, Like A11, Adam P12, Dee G13, Khoury M J14, Vulsma T15, Man E B16. The exact reason for congenital malformation among diabetic mother is still not clear by the fact that diabetes is responsible for a loss of normal homeostasis not only of carbohydrate but of fat and protein metabolism as well. The complication of uncontrolled glycemic level may cause micro vascular complications which may lead to additional metabolic changes such as hypoxia or impaired renal clearance of toxins. All studies of congenital anomalies in infants of diabetic mothers have shown cardiovascular, genitourinary, musculoskeletal, and other malformations. No single study has contained enough cases to determine whether or not the risk for each specific defect is significantly increased. The effect of gestational diabetes on malformations must be rules out in order to find clear evidence of overt diabetes (before and during pregnancy) and its direct relation to malformation. Chung and Myrianthropoulos17, attempted to find it and found that there was no increase in malformation risk in the pregnancies of mothers with gestational diabetes over that of nondiabetic mothers in either racial group. However, the risk of malformation for white mothers with overt diabetes was double that of nondiabetic mothers for both major and minor categories of malformations. The incidences of major and minor types of malformations in the pregnancies of overt diabetes were 17.94% and 10.94%, respectively, compared to the corresponding incidences of 8.34% and 6.25% for the nondiabetic group. There is still confusion that the complications of diabetes causes malformation of insulin used to treat diabetes acts as teratogens for malformation. Much research needs to be addressing these issues.

Thyroid disease is the second most common endocrine condition encountered in women of childbearing age after diabetes18. Most of the time thyroid disorders may adverse maternal and fetal outcome if they are not evaluated and managed appropriately. Thyroid dysfunctions are also the major cause malformation in present study. Hyperthyroidism during pregnancy is uncommon, affecting approximately 1 in 500 pregnancies19. Much evidence has been documented on hyperthyroidism impact on congenital anomalies20. Khoury et al21 found no overall relationship between maternal hypothyroidism or intake of thyroid drugs of thyroid drugs and the risk of infant
congenital malformations but noted a doubling of the risk of infants with multiple malformations but these presented no uniform pattern. Effect of thyroid disorder on pregnancy is one aspect whereas effect of treatment for thyroid disorders or other. Studies on effect of altered physiology due to thyroid dysfunction are many but effects of drugs used to treat thyroid dysfunction on congenital malformations are limited. This is because drug of choice for thyroid disorder is deferent from country to country. In the present study woman with thyroid disorders were prescribed Propylthiouracil (PTU) and methimazole (MMI)/carbimazole (CMZ). Clementi et al22, Myers AK23, Wilson LC24, Wolf D25 and Mandel SJ26 also found that these drugs may have impact on birth defect. There were 2 mothers diagnosed with both diabetes and hyperthyroidism and both were on prescribed medication.

Hypertensive disorders in pregnancy are categorized into four types: chronic hypertension, gestational hypertension, pre-eclampsia, and pre-eclampsia superimposed on chronic hypertension27. Chronic hypertension would be the most common causes because it effects right from the pregnancy. Treating mild to moderate hypertension is still debating but severer hypertension is treated with antihypertensive drugs. Hypertensions have direct effect on fetus development through uteroplacental insufficiency and hypertensive drugs act as a teratogens for malformations. Uteroplacental insufficiency lead to restricted blood flow to the developing fetus which increases the risk for certain types of malformations. This was supported by the results of Caton AR28, Clark E29, Bánhidy F30. There are many reviews shows that the hypertensive drugs are also leading cause for malformations. Caton AR28, Yakoob MY31, Lennestal R32, Puho EH33, Kallen BA34, Cooper W35, Yang C36 and Mitchell AA37.

Summary: Pregnancy should be properly planned in women with pre-existing any chronic disorders, and reached through lifestyle modifications, a healthy diet, and an exercise planning program with the supplementation of folic acid and multivitamins that is advocated to prevent malformations. If diagnosed early in the pregnancy, all of the complications as well as the conditions of congenital malformations could be prevented.

Conclusion

Our results support the hypothesis and previous study results that chronic disorders before and early pregnancy may play a role in the etiology of major birth defects; however, more research is needed to unravel which factors are involved in the pathophysiological mechanisms that may lead to birth defects.

Conflict of Interest: Author discloses no conflict of interest.

Source of Funding: No funding has been received for this study.

Ethical Clearance: Ethical permission has been obtained prior to study.

REFERENCE


36. Mitchell AA. Fetal risk from ace inhibitors in the first trimester. BMJ. 2011;343
Breast Cancer Data Classification Using Machine Learning Mechanisms

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ABSTRACT

During their life, among 8% of women is diagnosed with Breast cancer (BC), after lung cancer, BC is the second popular cause of death in both developed and undeveloped countries. BC is characterized by the mutation of genes, constant pain, changes in the size, color (redness), skin texture of breasts. Classification of breast cancer leads pathologists to find a systematic and objective prognostic, generally the most frequent classification is binary (benign cancer/malign cancer). Today, Machine Learning (ML) techniques are being broadly used in the breast cancer classification problem. They provide high classification accuracy and effective diagnostic capabilities. In this paper, we apply five different machine learning algorithms for classifying BC data, and results are visually represented.

Keywords: Breast Cancer; Classification; Machine Learning; lung cancer

Introduction

Breast Cancer’s causes multi factorial and involves family history, obesity, hormones, radiation therapy, and even reproductive factors. Every year, one million women are newly diagnosed with breast cancer, according to the report of the world health organization half of them would die, because it’s usually late when doctors detect the cancer [1,2]. Breast Cancer is caused by a typo or mutation in a single cell, which can be shut down by the system or causes a reckless cell division. If the problem is not fixed after a few months, masses are formed from cells containing wrong instructions. In this paper we are taking a few of machine learning algorithms for classifying BC data. The purpose of this article is effective understanding of cancer classification using machine learning approaches. The performance of each classifier will be evaluated in terms of accuracy, training process and testing process.

Literature Survey

A lot of studies have been done in the field of BC using classification, but still necessity of improving and visualizing the data for better understanding of issues. In this section we will discuss some of the techniques which are proposed by different authors in literature.

Rajaguru H. and Prabhakar S.K. [3] are proposed, a simple, cost effective and non-invasive strategy to detect the breast cancer at an early stage with the help of techniques such as Gaussian Mixture Model (GMM) and Radial Basis Function (RBF). As cancer staging is divided into clinical and pathological stage, the TNM (Tumour Node Metasis) prognostic tools are identified and the TNM variables such as tumour size, history of breast feeding, menstrual cycle, hereditary, food habits, etc. are used as input variables for both the types of classifications.

R. Nithya and B. Santhi [4] presents an evaluation and comparison of the performance of three different feature extraction methods for classification of normal and abnormal patterns in mammogram. Three different feature extraction methods used here are intensity histogram, GLCM (Grey Level Co-occurrence Matrix) and intensity based features. A supervised classifier system based on neural network is used. The performance of the each feature extraction method is evaluated on Digital Database for Screening Mammography (DDSM) breast cancer database.
Purnami SW et al. [5] emphasizes how 1-norm SVM can be used in feature selection and smooth SVM (SSVM) for classification. As a case study, a breast cancer diagnosis was implemented. First, feature selection for support vector machines was utilized to determine the important features. Then, SSVM was used to classify the state of disease (benign or malignant) of breast cancer. As a result, SVM can achieve the state of the art performance on feature selection and classification.

T.S.Subashini et al [6] paper compares the use of polynomial kernel of SVM and RBFNN in ascertaining the diagnostic accuracy of cytological data obtained from the Wisconsin breast cancer database. The data set includes nine different attributes and two categories of tumors namely benign and malignant. Known sets of cytologically proven tumor data was used to train the models to categorize cancer patients according to their diagnosis. Performance measures such as accuracy, specificity, sensitivity, F-score and other metrics used in medical diagnosis such as Youden’s index and discriminant power were evaluated to convey and compare the qualities of the classifiers.

Mehmet Fatih Akay [7] proposed breast cancer diagnosis based on a SVM-based method combined with feature selection. Experiments have been conducted on different training-test partitions of the Wisconsin breast cancer dataset (WBCD), which is commonly used among researchers who use machine learning methods for breast cancer diagnosis. The performance of the method is evaluated using classification accuracy, sensitivity, specificity, positive and negative predictive values, receiver operating characteristic (ROC) curves and confusion matrix.

Chaurasia, Vikas, and Saurabh Pal [8] investigate the performance of different classification techniques. The data breast cancer data with a total 683 rows and 10 columns will be used to test, by using classification accuracy. They analyse the breast Cancer data available from the Wisconsin dataset from UCI machine learning with the aim of developing accurate prediction models for breast cancer using data mining techniques.

Elif Derya Übeyli [9] integrated view of implementing automated diagnostic systems for breast cancer detection. The major objective of the paper is to be a guide for the readers, who want to develop an automated decision support system for detection of breast cancer. Because of the importance of making the right decision, better classification procedures for breast cancer have been searched. The classification accuracies of different classifiers, namely multilayer perceptron neural network (MLPNN), combined neural network (CNN), probabilistic neural network (PNN), recurrent neural network (RNN) and support vector machine (SVM), which were trained on the attributes of each record in the Wisconsin breast cancer database, were compared. The purpose was to determine an optimum classification scheme with high diagnostic accuracy for this problem.

Seral Şahan et al [10] diagnosing breast cancer with a new hybrid machine learning method. By hybridizing a fuzzy-artificial immune system with k-nearest neighbour algorithm, a method was obtained to solve this diagnosis problem via classifying Wisconsin Breast Cancer Dataset (WBCD). This data set is a very commonly used data set in the literature relating the use of classification systems for breast cancer diagnosis and it was used in this study to compare the classification performance of our proposed method with regard to other studies.

**Methodology**

A simulated system is developed to predict various breast cancer classification conditions using various Data Analysis and Machine Learning techniques. The main source of data to be collected from the web link https://www.kaggle.com/uciml/breast-cancer-wisconsin-data. The system takes breast cancer dataset and splitting it into training and testing, clean it. Different classifiers are applied on testing data based on the values of training. The classifiers are predict the data and validation will applied on predicted data, testing and training data. Finally accuracy, precision, recall, f1 score is measured.

**Data Set**: The dataset consists of 569 data points, with 32 features each:

```python
['id', 'diagnosis', 'radius_mean', 'texture_mean', 'perimeter_mean', 'area_mean', 'smoothness_mean', 'compactness_mean', 'symmetry_mean', 'concave points_mean', 'fractal_dimension_mean',
 'radius_se', 'texture_se', 'perimeter_se', 'area_se', 'smoothness_se', 'compactness_se', 'symmetry_se',
 'concave points se', 'fractal_dimension se', 'radius_worst', 'texture_worst',
 'perimeter_worst', 'area_worst', 'smoothness_worst', 'compactness_worst', 'symmetry_worst',
 'concave points worst', 'fractal_dimension Worst', 'dtype=’object’]
```
Of these 569 data points, 212 are labeled as malignant and 357 as benign which are shown in Fig 1.

**Fig. 1: Features of breast cancer dataset**

**k-Nearest Neighbors:** The k-NN algorithm is arguably the simplest machine learning algorithm. Building the model consists only of storing the training dataset. To make a prediction for a new data point, the algorithm finds the closest data points in the training dataset—its “nearest neighbors.” Let’s investigate whether we can confirm the connection between model complexity and accuracy.

**Fig. 2: Training and test set accuracy of KNN**

The plot shows in Fig 2, the training and test set accuracy on the y-axis against the setting of n_neighbors on the x-axis. Considering a single nearest neighbor, the prediction on the training set is perfect. But when more neighbors are considered, the training accuracy drops, indicating that using the single nearest neighbor leads to a model that is too complex.

The best performance is somewhere around three neighbors. Still, it is good to keep the scale of the plot in mind. The worst performance is more than 90% accuracy, which might still be pretty good.

The above plot suggests that we should choose n_neighbors=3. Here we are:

Accuracy of K-NN classifier on training set: 0.96
Accuracy of K-NN classifier on test set: 0.92

**Logistic Regression:** One of the most common linear classification algorithms is logistic regression. Despite its name, LogisticRegression is a classification algorithm and not a regression algorithm.

Training set score: 0.955
Test set score: 0.937

The default value of C=1 provides quite good performance, with 96% accuracy on training and 0.94 accuracy on test set. Let’s try to increase C to fit a more flexible model to see whether we can improve the performance.

Training set score: 0.969
Test set score: 0.972

Using C=100 results in higher accuracy on both training set and test set, confirming that less regularization and a more complex model should perform better.

Training set score: 0.948
Test set score: 0.895

Using C=0.01 results in lower accuracy on the training set and much lower accuracy on the test set, indicates our model doesn’t generalize well from our training data to unseen data. With C=0.01, overfitting occurs. The data is shown in Fig 3.

**Fig. 3: Logistic regression data visualization**
**Decision Tree:** This is one of my favorite algorithm and I use it quite frequently. It is a type of supervised learning algorithm that is mostly used for classification problems. Surprisingly, it works for both categorical and continuous dependent variables. In this algorithm, we split the population into two or more homogeneous sets. This is done based on most significant attributes/independent variables to make as distinct groups as possible.

Accuracy on training set: 1.000

Accuracy on test set: 0.937

Feature importance in trees: feature importance rates how important each feature is for the decision a tree makes. It is a number between 0 and 1 for each feature, where 0 means “not used at all” and 1 means “perfectly predicts the target.” The feature importances always sum to 1: We can then visualize the feature importances in Fig 4. Feature perimeter_worst is by far the most important feature. This confirms our observation in analyzing the tree that the first level already separates the two classes fairly well.

![Feature importance of breast cancer dataset](image)

**Random Forest:** Random Forest is a trademark term for an ensemble of decision trees. In Random Forest, we’ve collection of decision trees (so known as “Forest”). To classify a new object based on attributes, each tree gives a classification and we say the tree “votes” for that class.

The forest chooses the classification having the most votes (over all the trees in the forest).

Accuracy on training set: 1.000

Accuracy on test set: 0.958

The random forest gives us an accuracy of 95.8%, better than a single decision tree, without tuning any parameters. Feature importance in Random Forest is shown in Fig 5.

Similarly to the single decision tree, the random forest also gives a lot of importance to the “worst radius” feature, but it also chooses “perimeter worst” to be the most informative feature overall. The randomness in building the random forest forces the algorithm to consider many possible explanations, the result being that the random forest captures a much broader picture of the data than a single tree.
Gradient Boosting: GBM is a boosting algorithm used when we deal with plenty of data to make a prediction with high prediction power. Boosting is actually an ensemble of learning algorithms which combines the prediction of several base estimators in order to improve robustness over a single estimator.

Accuracy on training set: 1.000

Accuracy on test set: 0.944

As the training set accuracy is 100%, we are likely to be overfitting. To reduce overfitting, we could either apply stronger pre-pruning by limiting the maximum depth or lower the learning rate:

Accuracy on training set: 0.988

Accuracy on test set: 0.937

Accuracy on training set: 0.984

Accuracy on test set: 0.930

Both methods of decreasing the model complexity reduced the training set accuracy, as expected. In this case, none of these methods increased the generalization performance of the test set. Still, we can visualize the feature importances to get more insight into our model even though we are not really happy with the model.

We can see that the feature importances of the gradient boosted trees (shown in Fig 6) are somewhat similar to the feature importances of the random forests, though the gradient boosting completely ignored some of the features.
Support Vector Machine: An SVM generates parallel partitions by generating two parallel lines. For each category of data in a high-dimensional space and uses almost all attributes. It separates the space in a single pass to generate flat and linear partitions.

- Accuracy on training set: 1.00
- Accuracy on test set: 0.63

The model overfits quite substantially, with a perfect score on the training set and only 63% accuracy on the test set.

SVM requires all the features to vary on a similar scale. We will need to rescale our data that all the features are approximately on the same scale.

- Accuracy on training set: 0.95
- Accuracy on test set: 0.94

Scaling the data made a huge difference! Now we are actually in an underfitting regime, where training and test set performance are quite similar but less close to 100% accuracy. From here, we can try increasing either C or gamma to fit a more complex model.

- Accuracy on training set: 0.986
- Accuracy on test set: 0.965

Here, increasing C allows us to improve the model significantly, resulting in 96.5% test set accuracy.

Neural Networks: It is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system.

- Accuracy on training set: 0.63
- Accuracy on test set: 0.63

This is likely due to scaling of the data. Neural networks also expect all input features to vary in a similar way, and ideally to have a mean of 0, and a variance of 1. We must rescale our data so that it fulfills these requirements.

- Accuracy on training set: 0.962

Accuracy on test set: 0.958

The results are much better after scaling, and already quite competitive.

- Accuracy on training set: 0.958
- Accuracy on test set: 0.979

The weights that were learned connecting the input to the first hidden layer. The rows in this plot correspond to the 30 input features, while the columns correspond to the 100 hidden units. Light colors represent large positive values, while dark colors represent negative values. One possible inference we can make is that features that have very small weights for all of the hidden units are “less important” to the model. We can see that “mean smoothness” and “mean compactness,” in addition to the features found between “smoothness error” and “fractal dimension error,” have relatively low weights compared to other features. This could mean that these are less important features or possibly that we didn’t represent them in a way that the neural network could use.

Conclusions

In this paper breast cancer dataset is classified using different machine learning algorithms. The results are visualized for features of the dataset. For these methods accuracy, precision, recall is measured, from accuracy point of view. For training dataset accuracy is 0.96 for KNN, 0.969 for LR, 0.98 for DTC, 1 for RF, 0.98 for GB, 0.98 for SVM and 0.95 for NN. For testing dataset accuracy is 0.92 for KNN, 0.97 for LR, 0.93 for DTC, 0.95 for RF, 0.93 for GB, 0.96 for SVM and 0.97 for NN. From these statistics RF outperforms in training KNN and NN in testing.

Ethical Clearance: We took breast cancer dataset and splitting it into training and testing, clean it. The main source of data is collected from the web link https://www.kaggle.com/uciml/breast-cancer-wisconsin-data. Different classifiers are applied on testing data based on the values of training. The classifiers are predict the data and validation will applied on predicted data, testing and training data.

Source of Funding: Self

Conflict of Interest: Nil
REFERENCES


Lactose Intolerance and Oral Health: A Public Health Promotional Perspective

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ABSTRACT

Introduction: The percentage of individuals with lactose intolerance and milk allergy is rising in the populations world wide, with some races showing more predilection towards intolerance. It is being increasingly seen in adults, in addition to its known effects on children.

Objective: To assess the potential effects of lactose intolerance on oral health.

Background: Individuals affected by lactose intolerance often practise dairy-exclusion diets to avoid symptoms provoked by lactose intake. This dietary restriction results in a significant lower intake of calcium among affected subjects. Substitution of dairy products with other soy-based or lactose-free food may also have a local effect to the oral environment. The aim of this review is to summarize the relevant studies which have been conducted in this area and identify areas which need further investigation.

Method: The authors retrieved relevant literatures from searches of electronic databases (Google Scholar, PubMed and Scopus), hand searches of the references of retrieved literature and authoritative texts. Terms searched included the following: lactose intolerance, oral health, milk allergy, milk, dairy, teeth, lactase deficiency, lactose and tooth loss.

Discussion: The effects of dietary restrictions in lactose-intolerant subjects on dental caries, periodontal diseases, osteoporosis and ridge resorption, dental fluorosis and the role of probiotics are discussed.

Conclusion: The association between lactose intolerance and oral health is ambiguously defined. Till date, it appears that not many studies have been done to investigate the relationship between lactose intolerance and oral health. More studies of higher level of evidence are required to further examine and confirm the effect of lactose intolerance on oral health.

Keywords: Lactose intolerance, oral health, milk allergy, dairy, lactase deficiency

Introduction

Lactose intolerance is a condition characterized by gastrointestinal symptoms such as diarrhoea, flatulence, abdominal pain and/or bloating post intake of lactose. This occurs because of the decreased ability of the body to hydrolyse lactose, a disaccharide, into glucose and galactose, due to a deficiency in enzyme lactase (also known as β-galactosidase).¹

Lactase deficiency can be of three types: primary, secondary or congenital. Primary form is the most common where production of lactase decreases naturally.
with age. Secondary causes usually follow any gastrointestinal diseases which damage the intestinal mucosa, such as Crohn’s disease and Celiac disease. Congenital lactase deficiency is rare, which is present at birth due to autosomal recessive trait.

The concept of lactose intolerance is vague, as not all symptomatic individuals were confirmed by microbiological diagnosis as lactase enzyme deficient. Instead, many have self-perceived that they are lactose intolerant, in which case lactase deficiency is not the cause of their gastrointestinal symptoms.

Individuals with true or self-perceived lactose intolerance often avoid intake of milk and dairy products, putting themselves at risk of calcium deficiency. Dairy products are known to be rich and have always been associated with better bone health, including dental hard tissues. They contribute to approximately 75% of total dietary calcium intake. Even though this essential nutrient can be obtained from other non-dairy sources, its’ bioavailability may be low, especially if it is of plant origin. For example, approximately 10 cup servings of sweet potatoes would be needed to equal the calcium content in a cup of milk. It may thus be difficult to meet the recommended levels of calcium from non-dairy food sources alone.

This dietary modification may impose systemic and local effects on oral health, such as through the reduced intake of calcium or change in the substrate for oral microbiota.

Many research have been carried out to investigate the relationship between milk and oral health, however, not many have studied the effects of reduced intake of dairy products due to lactose intolerance on oral health.

**Method**

Electronic databases namely Google Scholar, PUBMED and Scopus were searched using terms ‘lactose intolerance’, ‘oral health’, ‘milk allergy’, ‘dental’, ‘milk’, ‘dairy’, ‘teeth’, ‘lactase deficiency’, ‘fluorosis’ and ‘lactose’ through December 2018. The authors also hand searched references from the retrieved literatures. They excluded animal studies, articles not published in English language, case reports and editorials but read them to identify any relevant literatures.

**Identified Areas of Focus:**

**Dental Caries:** Dental caries occurs as a result of interaction between three variables over a suitable period of time: 1) pathogenic oral microbes; 2) fermentable carbohydrates which will be metabolized to acids; 3) susceptible teeth. Lactose is the least cariogenic among common dietary sugars. Controversies are existing regarding the cariogenicity of milk. Some studies reported that milk can cause early childhood caries, while other studies suggested that milk, particularly bovine milk as well as dairy products, if unsweetened artificially, due to the high concentration of calcium, phosphate, casein, whey proteins and lipids, actually possesses anti cariogenic properties.

Milk intake has been reported to have an inverse association with caries development in children and adolescents. It’s high calcium and phosphorus content protects teeth against demineralization and helps in remineralisation.

Dairy-derived bioactive peptides such as Caseinophosphopeptides (CPP) and glycomacropeptides (GMP) have been patented for use in various anti-caries products such as dentifrices, mouthwash and tooth mousse. It is important to note that lactose intolerance differs from casein allergy, and hence these products can be used safely in people afflicted by lactose-intolerance.

Lactose-intolerant individuals eliminated dairy products from their diet and tend to opt for soy-based or lactose-free products as substitutes, which contain different carbohydrate sources like sucrose, corn syrup and glucose polymers. Various studies have shown that these non-milk extrinsic sugars have higher cariogenic potential than lactose, with sucrose being the most cariogenic.

Sheikh C. et al showed that soy-based and protein hydrolyzate formulations are more acidogenic compared to the milk-based formulations. This is in agreement with studies done by Birkhed et al.

Moimaz SAS et al reported higher caries prevalence and significantly higher mean dmft (decayed, missing, and filled teeth) index in children with lactose intolerance/cow milk protein allergy, though no significant association between dental caries and replacement food is found.
Thitasomakul S found a significant association between higher maternal intake of cheese during pregnancy with reduced risk of dental caries in children and borderline significance for the negative correlation between maternal intake of total dairy products, yoghurt and calcium during pregnancy and childhood dental caries. This may be due to the influence of maternal calcium intake on primary tooth mineralization and subsequent acid-resistance of tooth enamel.27 This implies that children of mothers who are lactose intolerant and are not supplemented with calcium during pregnancy may have higher risk of childhood caries. However, the result of this study may be merely a chance and higher maternal intake of cheese simply implies a healthier diet and/or lifestyle in general.

Information on the effects of lactose intolerance on dental caries is limited. Diet factors alone cannot contribute to dental caries as it is confounded by other factors such as oral hygiene measures and fluoride exposures. With proper oral hygiene practices, caries risk can be reduced.

**Periodontal Diseases:** Periodontal disease is an inflammatory disease affecting the supporting tissues of the teeth, resulting in progressive attachment loss and alveolar bone destruction.28 It is one of the main causes of tooth loss besides dental caries.29

Poor diet and nutritional deficiencies, especially calcium, have been quoted as one of the possible risk factors for periodontitis.30 Studies which utilized data from the Third National Health and Nutrition Examination Survey (NHANES III) revealed that low dietary intake of calcium was associated with higher periodontitis prevalence and more calculus deposits.31

Adegboye AR et al through two separate studies (cohort 32 and cross-sectional 33) done in the Danish population, found significant inverse correlations between intakes of calcium from dairy products, particularly from milk and fermented foods, with severity of periodontitis/tooth loss; while no significant association was found with non-dairy calcium.

Shimazaki et al investigated the type of dairy food that affects periodontal health and reported that among all dairy products studied only lactic acid fermented food had significant association with periodontal disease and clinical attachment loss, suggesting that dairy calcium did not play an important role in periodontitis.34 The presence of probiotic bacteria was thought to suppress the growth of periodontal pathogens and influence the disease progression.35 However, as the potential for independent effects of calcium was not considered and that the study design was cross-sectional, it is not possible to conclude that calcium intake has no influence on periodontal disease.

As calcium intake affects bone mineral density in the body including alveolar bone, it in turn affects the retention of natural dentition.36

Due to the dietary restrictions of lactose-intolerant individuals, they are considered to be at-risk group for calcium deficiency, if adequate calcium intake was not met with other dietary sources. They may be more susceptible to develop periodontitis or experience a faster progression of disease, if other risk factors such as local bacterial plaque are not kept in check.

Dairy calcium may exert a prophylactic effect on periodontitis, but further prospective studies are required to confirm the causal relationship.

**Osteoporosis and Ridge Resorption:** Lactose intolerance is believed to be associated with the risk for osteoporosis as it can induce derangement of bone through the reduced intake of calcium.37 Intolerant subjects were shown to have significantly higher aversion to milk consumption.38, 39 The low-lactose diet resulted in significantly lower calcium intake and Bone Mineral Density (BMD) value, which exposes subjects to higher risk of severe osteoporosis.40 Similar findings have also been reported in children 41 and post-menopausal women42 with documented lactose intolerance.

Although data from literature show that intolerant subjects are unable to achieve an adequate peak bone mass, these studies measured BMD at non-oral sites; their relevance to oral site is unknown.

In edentulous individuals, it has been reported that systemic osteoporosis has a significant influence on residual alveolar ridge resorption43 inducing a greater rate of bone loss. 44 However, questions were raised regarding the significance of the resorption.45,46

Nishimura I and colleagues found that osteoporosis causes specific type of bone resorption along the buccal-lingual direction, resulting in a “knife-edge” ridge over time.47 Singhal S et al suggested that recall visit for this group of patients should be done more often as they may need more frequent denture adjustments due to the greater resorption rate.
Evidence showed that intake of milk per se has a protective effect against osteoporosis.\textsuperscript{48} Lactose intolerance alone does not impair absorption of calcium in the body\textsuperscript{49}, however, exclusion of calcium-rich dairy products from diet may cause inadequate bone mineralization if calcium requirement is not met by other dietary sources.

**Fluorosis:** Fluoride plays a great role in caries prevention in the population if taken at the optimal level of between 0.05 and 0.07 mg fluoride per kilogram of body weight (mgF/kg bw).\textsuperscript{50} However, an increased intake of fluoride during tooth development can cause dental Fluorosis\textsuperscript{51}, an unaesthetic alteration in the enamel of tooth.

Milk constitutes the main source of energy and nutrition during the early years of life. Infants and children with documented lactose intolerance are often fed with soy-based formulas. Mc-Knight Hanes et al found that the fluoride concentrations in all soy-based formulas were significantly higher than that present in all milk-based formulas investigated. This was attributed to the different processes involved in milk formulas production and the higher content of phytates and tricalcium phosphates in soy-based formulas which bind to fluoride.\textsuperscript{52}

Two other studies also reported that soy-based formulas contain higher fluoride concentration and may predispose infants to dental fluorosis.\textsuperscript{52} However, there were controversies regarding the bioavailability of fluoride in milk formulas\textsuperscript{53} and its ability to be the sole causative agent.

Other studies reported low fluoride content in different infant formulas, and they were unlikely to exceed the upper threshold of daily recommended fluoride intake alone, unless reconstituted with fluoridated water of 1.0 ppm F or above.\textsuperscript{54,55}

De Carvalho C et al showed that very mild and mild forms of dental fluorosis in the primary dentition was associated with lactose intolerance, however there was no significant correlation with isolated consumption of manufactured soy-based food. Hujoel PP et al found that the fluoride concentration in infant formulas only has weak causal relationship to dental fluorosis.\textsuperscript{54}

Commercialized infant formulas, whether milk-based or soy-based, generally have varying composition and fluoride concentration. One cannot affirm that all soy-based formulas in the market has higher fluoride content than milk-based formulas and predispose its consumers to dental fluorosis. The questionable bioavailability of fluoride in milk formulas and the presence of other sources of fluoride such as food, water and toothpastes\textsuperscript{55} showed that fluorosis may not be directly and solely related to consumption of fluoridated milk formulas.

Hence, lactose-intolerant subjects who opt for soy-based formulas as substitutes are not particularly at risk of developing dental fluorosis compared to the general population.

**Dietary Management:** Lactose intolerance can be improved through diet modification\textsuperscript{56}, though subjects with secondary lactose intolerance often need further treatment to address the underlying condition. Once the underlying cause is treated, they can gradually resume intake of lactose.

Evidence show that individuals diagnosed with lactose intolerance do not need to practise a dairy-exclusion or severely-restricted diet\textsuperscript{57} as lactose intolerance is dose-dependent\textsuperscript{58} and most could tolerate up to 12g (equivalent to the lactose content in a cup of milk) in a single dose, taken alone, with no or minimal symptoms. When taken with meals, many can ingest 2 cups of milk without appreciable symptoms. If dietary calcium intake is inadequate, the daily calcium requirements need to be met from other dietary sources or supplements to prevent nutritional deficiency.\textsuperscript{59}

Probiotics, found in fermented and unfermented milk products, have been reported to bring beneficial effects to intolerant individuals.\textsuperscript{59} Microorganisms present, mainly the *Lactobacillus* and *Bifidobacterium spp.*, have endogenous lactase activity and help to break down lactose.\textsuperscript{60} Although conflicting results have also been published regarding the role of probiotics in lactose intolerance, frequent intake of probiotics was shown to contribute to overall oral health, either through direct local interaction with bacterial plaque or through indirect modulation of immune response. By altering the oral microbial ecology and suppressing the level of pathogenic bacteria, probiotics were observed to cause significant improvements in periodontal health and demonstrated some potential to reduce caries risk.\textsuperscript{61} Individual lifestyle, as it relates to the physical form of food and beverages consumed, individual susceptibility, and oral hygiene practice are considered the most important factors for development of dental caries.\textsuperscript{62}
Conclusion

Various aspects of oral health have been extensively studied worldwide. However, a clear focus on individuals with lactose intolerance and their general/dental health needs to be prioritised to come up with comprehensive dietary modifications and recommendations for improving the activities of daily living, health outcomes and quality of life in individuals in the community. Professionals in the fields of public health, health promotion, nutrition and dietary counselling are expected to play an important role in this direction in the coming decade.

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Ethical Clearance: Not indicated

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Awareness of CPA (Consumer Protection Act) among Oral and Maxillofacial Surgeons of South India

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ABSTRACT

Introduction: Consumer protection act (CPA) an act to provide for better protection of interests of customers. With increased consumer awareness, rising expectation, western trend of medical liability litigation and judicial activism the increasing number of complaints are being filed by dissatisfied patients resulting in growing distrust between patients and doctors and increased cost of medical treatment. Hence this study was designed to assess the level of awareness about Consumer Protection Act/CPA among the Oral & Maxillofacial Surgeons.

Materials and Method: A questionnaire based cross-sectional study was conducted among Oral & Maxillofacial Surgeons. Data was collected over a period of two months. The questionnaire consisted of 18 questions of CPA relevant to the Oral & Maxillofacial Surgeon. A written informed consent was obtained from each participant before filling the questionnaire. The data were analyzed using Statistical Package for the Social Sciences version 16.0 software (SPSS Inc., Chicago, Illinois, USA) Descriptive statistics were obtained and frequency distribution was calculated for awareness among Oral surgeons regarding CPA.

Results: The questionnaire had 18 items and options had to be selected. This survey comprised of a total of 300 participants. About 71 questionnaire were not filled completely, so they were excluded from the final analysis. The final sample included 6 Professors, 50 Associate Professors, 53 Assistant Professors, 120 Post graduates. The aim and objectives of CPA was known to only 37.2% of the participants. About 63.7% were aware that consumers lodge a complaint without the presence of a lawyer. The least correct answers were given to questions related to which level compensation claim of Rs15 lakhs should be made, and who can give consent for examination for a 15 year old patient. When asked what should be done to the consent form after treatment is over, 66.7% of professors, 80.8% of associate professors, 96.6% of assistant professors and 77.7% of post graduate students were aware that it should be preserved by the dentist. The maximum correct answers were given by the professors.

Discussion & Conclusion: In the present study, although the majority of subjects were aware of CPA, the analysis of data revealed that some misconceptions among the subjects about the liability of the practitioners in various circumstances. To conclude, the authors advocated the need to update understanding of Consumer Protection Act and its amendments to be legally correct

Keywords: Consumer Protection Act, Awareness, Questionnaire study
Introduction

Health is wealth. But if health is lost, one has to meet the doctor. Doctors are considered to be the visible Gods. Doctors are the trustworthy persons. A patient who approaches a doctor with an ailment will presume that he is the right and capable person to cure his defect. So there is also a duty on the part of the doctor to perform such obligation with proper care.

Nowadays, medical profession has become commercialized. Doctors adopt deceitful practices so as to attract the innocent patients and thereby collect money in huge amounts. The state has taken a lot of responsibilities to prevent those practices, but there is still room for lot to be done. Article 21 of the Indian Constitution impose an obligation on the state to safeguard the Right in Life of every person.

Apart from all types of deceitful practices, even at the time of treating the patients, doctors act negligently. This is not excusable. For that purpose they brought under the Consumer Protection Act, 1986 and amendments followed in 1991 and 2002. This is an act to provide for better protection of interests of customers and for that purpose to make provision for the establishment of consumer councils and other authorities for the settlement of consumer’s disputes and for the matters concerned therewith. Other laws are preventive in nature whereas CPA provides compensation. With increasing awareness of the consumers, rising expectation, medical liability litigation, and judicial activism, increasing number of complaints are being filed by dissatisfied patients resulting in growing distrust between patients and doctors and increased cost of medical treatment 3. Thus, a professional should have equal amount of knowledge as is entitled for the ordinary counterpart of his profession. He should be updated with the knowledge of new advances, discoveries and developments in his field as well as be aware of the deficiencies in his knowledge and the limitations of his skills. He should be alert to the hazards and risks in any professional task he undertakes to the extent that other ordinarily competent members of the profession would be. He must bring to any professional task he undertakes no less expertise, skill and care than other ordinarily competent members of his profession would bring, but need bring no more. Therefore a study regarding awareness of CPA is necessary to protect ourselves in case of litigation. Hence this questionnaire study was designed to gauge the level of awareness about Consumer Protection Act/ CPA among the Oral & Maxillofacial Surgeons.

Materials and Method

A questionnaire based cross-sectional study among Oral & Maxillofacial Surgeons from hospitals in South India was carried out. Data was collected during the month of Jan- Feb in 2016. Institutional scientific and ethical committee clearance was obtained before the initiation of the study. The questionnaire consisted of 18 questions covering the important aspects of CPA relevant to the Oral & Maxillofacial Surgeons. Prior to the data collection, the questions were pretested among a group of 5 professionals, in order to ensure the level of validity and degree of repeatability. The assessment of content validity in the questionnaire was related to the opinions expressed by a group of five academicians working in different institutions, in addition to their experiences in their own dental clinics. A written informed consent was obtained from each participant before taking the questionnaire. On completion of the questionnaire, the correct responses to all the questions, according to CPA, were given to all the participants.

The data was analyzed using Statistical Package for the Social Sciences version 16.0 software (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were obtained and frequency distribution was calculated for awareness regarding CPA among practitioners. Chi-square test was applied to check the statistical significance between the opinions among different designation.

Result

The questionnaire had 18 items and options had to be selected. This survey comprised of a total of 300 participants. About 71 questionnaire were not filled completely, so they were excluded from the final analysis. It included 6 Professors, 50 Associate Professors, 53 Assistant Professors, 120 Post graduates. The correct responses given by the respondents were depicted in Table 1. The aim and objectives of CPA was known to only 37.2% of the participants. About 63.7% were aware that consumers lodge a complaint without the presence of a lawyer. The least correct answers were given to questions related to which level compensation claim of Rs15 lakhs should be made, and who can give consent for examination for a 15 year old patient.
<table>
<thead>
<tr>
<th>Questions</th>
<th>Correct responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Q1</strong> Which of the following is NOT the aims and objective of COPRA?</td>
<td>Prof 4(66.7) Ass.prof 21(42) Asst.prof 20(37.7) PG 63(52.5) 5.20* 6** 0.51***</td>
</tr>
<tr>
<td><strong>Q2</strong> Can a consumer lodge a complaint without the presence of a lawyer?</td>
<td>6(100) 41(70.7) 47(79.7) 95(63.8) 10.00* 6** 0.12***</td>
</tr>
<tr>
<td><strong>Q3</strong> Can a patient sue a doctor for rejecting an emergency case?</td>
<td>4(66.7) 44(75.9) 49(81.7) 116(76.8) 4.22* 6** 0.64***</td>
</tr>
<tr>
<td><strong>Q4</strong> Can a patient sue a doctor for rejecting a medically compromised case?</td>
<td>4(66.7) 33(56.9) 38(63.3) 78(51.3) 14.84* 6 0.02** 0.04***</td>
</tr>
<tr>
<td><strong>Q5</strong> Doctors or hospitals paid by an insurance firm for treatment of client</td>
<td>5(83.3) 35(62.5) 41(71.9) 90(61.2) 3.85* 6** 0.69***</td>
</tr>
<tr>
<td><strong>Q6</strong> Doctors in hospitals who do not charge their patients at all (even registration fee) are</td>
<td>1(16.7) 27(46.6) 34(57.6) 77(51.3) 13.04* 6** 0.04***</td>
</tr>
<tr>
<td><strong>Q7</strong> At which level should a compensation claim of Rs15 lakhs be made</td>
<td>4(66.7) 20(39.2) 24(51.1) 55(45.1) 4.25* 6** 0.64***</td>
</tr>
<tr>
<td><strong>Q8</strong> The centre which the patient approaches to file a complaint is determined by</td>
<td>3(50) 12(12.2) 16(28.6) 34(23.3) 4.83* 6** 0.56***</td>
</tr>
<tr>
<td><strong>Q9</strong> What is the maximum time period within which a patient can sue the concerned doctor with evidence?</td>
<td>2(33.3) 22(40.7) 10(16.9) 58(40.8) 36.41* 6 0.00***</td>
</tr>
<tr>
<td><strong>Q10</strong> If the patient or attendants are erring on any account (history not reliable, refusing investigations, refusing admissions) do you ALWAYS make a note of it/seek written refusal?</td>
<td>6(100) 35(64.8) 38(67.9) 86(64.2) 5.67* 6 0.46***</td>
</tr>
<tr>
<td><strong>Q11</strong> Do you explain the diagnosis, prognosis and treatment plan to your patient?</td>
<td>6(100) 49(94.2) 52(89.7) 130(89) 2.46* 6** 0.87**</td>
</tr>
<tr>
<td><strong>Q12</strong> Do you ALWAYS take a written consent from your patient once you explain the treatment procedures?</td>
<td>4(67.2) 29(52.7) 39(67.2) 114(79.2) 36.50* 6** 0.00***</td>
</tr>
<tr>
<td><strong>Q13</strong> What should a doctor do in case of a mishap?</td>
<td>6(100) 49(92.5) 52(96.3) 139(97.2) 8.12* 6 0.22***</td>
</tr>
<tr>
<td><strong>Q14</strong> Written consent is valid in which of the following</td>
<td>6(100) 49(94.2) 48(88.9) 108(74) 14.55* 3 0.02***</td>
</tr>
<tr>
<td><strong>Q15</strong> For a patient 15 years of age, consent for examination is taken from</td>
<td>5(83.3) 17(38.6) 18(37.5) 64(50.4) 14.18* 6** 0.02***</td>
</tr>
<tr>
<td><strong>Q16</strong> Situations where consent may not be obtained</td>
<td>33(62.3) 6(100) 41(70.7) 92(65.2) 6.02* 6** 0.42***</td>
</tr>
<tr>
<td><strong>Q17</strong> Should informed consent refer to one specific procedure at a time?</td>
<td>6(100) 52(100) 55(98.2) 141(97.9) 1.20* 3 0.75***</td>
</tr>
<tr>
<td><strong>Q18</strong> What should be done to informed consent form after treatment is over?</td>
<td>4(66.7) 42(80.8) 56(96.6) 115(77.7) 15.40* 6** 0.01***</td>
</tr>
</tbody>
</table>

% in parenthesis * Chi-square value ** df ***p value
When asked what should be done to the consent form after treatment is over, 66.7% of professors, 80.8% of associate professors, 96.6% of assistant professors and 77.7% of postgraduate students were aware that it should be preserved by the dentist. There was a great deal of misconception among 16.7% of professors, 46.6% of associate professors, 57.6% of assistant professors and 51.3% of postgraduate students about liability of doctors who do not charge their patients, even the registration fee.

Out of the 18 questions, the question number 4, 6, 9, 12, 14, 16, 18 revealed statistical significance difference in the opinion between professors, associate professors, assistant professors and postgraduate students. (Table 1). In a total of 18 questions, maximum correct answers were given by the professors.

Discussion

Consumer Protection Act came into force on April 18th 1986 and amendments followed in 1991 and 2002. An act is provided for better protection of interests of customers, and for that purpose provisions have been made for the establishment of Consumer Councils and other authorities for the settlement of consumer’s disputes and for the matters concerned therewith. Ramya Shenoy et al (2009) conducted a questionnaire study with the aim of assessing the awareness among dentist regarding the Consumer Protection Act. This study showed that interns were less aware as compared to the faculty. The study carried out by Gambhir et al showed that graduates had less knowledge scores compared to those who have completed post-graduation.

In the present study, although the majority of subjects were aware of CPA, the analysis of data collected revealed some misconceptions among the subjects about the liability of the practitioners in various circumstances. Out of the 18 questions the following questions on patient can sue a doctor for rejecting a medically compromised case; Doctors in hospitals who do not charge their patients at all (even registration fee); the maximum time period within which a patient can sue the concerned doctor with evidence and about written informed consent revealed statistical significance difference in the opinion between professors, associate professors, assistant professors and postgraduate students. Overall, the maximum correct answers were given by the professors.

To conclude, the authors advocated the need to update understanding of Consumer Protection Act and its amendments. It is always better to take necessary steps to protect ourselves in case of litigation.

Ethical Clearance: Taken from Institutional Ethics Committee letter dated Protocol No.09064

Source of Funding: Self

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A Study on Performance Evaluation of Selected ICICI Prudential Mutual Fund Schemes

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ABSTRACT

The reforms in the financial sector and many developments in Indian money market and capital market have made Mutual Funds as an important portal for the investors to invest their savings in different schemes. The revolution in the development of communication technology also has become so advanced which acts as a link between the issuers of financial instruments and the global investors. Hence mutual funds became a most appropriate investment avenue for individual investors as it offers the advantage of professional management of money, portfolio diversification, reduced transaction cost and liquidity. An attempt has been made to analyse the performance of different ICICI Prudential mutual fund schemes which has been included in the sample during the study period of 2017-18 consisting of 12 months. In order to achieve the pre-determined objectives, an analysis has been made to compare these schemes with the market on the basis of risk and return.

Keywords: Mutual funds, Risk, Return and Portfolio

Introduction

A Mutual Fund is a trust that pools the savings of a number of small investors, in the form of units, who have a common financial goal. The money thus collected by them is invested in financial market instruments such as shares, debentures, bonds, money market instruments or some combination of these investments in such a way, as to minimize risk, while ensuring safety and a steady return on investment.¹ Mutual funds have been a new outlook to millions of investors which take investment to their door step. The investment habit of the investors has undergone a sea change.² Increasing number of players from public as well as private sectors has entered into the market with innovative schemes to cater the requirements of the investors in India as well as abroad. Mutual funds have increasingly become the investor’s vehicle of choice of investment. The relationship between risk and return determines the performance of a mutual fund scheme, therefore providing maximum return on the investment made within the acceptable associated risk level helps in segregating the better performers from the laggards.³ Hence an attempt has been made to analyse the performance of different ICICI Prudential mutual fund schemes which has been included in the sample during the study period of 2017-18 consisting of 12 months. In order to achieve the pre-determined objectives, an analysis has been made to compare these schemes with the market on the basis of risk and return.⁴

Objectives of the Study

- To examine the concept of Mutual funds in Indian stock market.
- To evaluate the systematic and unsystematic risk of selected ICICIPrudential mutual fund Schemes.
- To examine the relative performance of selected ICICI Prudential mutual fund Schemes by applying Sharpe ratio and Treynor ratio.

Methodology

The study is mainly based on secondary data which was collected from the data sources like factsheets of mutual funds, magazines on mutual funds, articles,
newspapers, AMFI reports and its website. The performance evaluation has been carried out for a five schemes selected for the study. These schemes were selected randomly from ICICI Prudential Mutual fund as it stands top with the average asset under management of Rs.305739 crores as on 31st March 2018. A period of 12 months ranging from 1st April 2017 to 31st March 2018 has been considered in evaluating the performance of the funds. The selected five schemes were taken from the growth/equity schemes of open-ended mutual funds.

The study employed the post office saving deposit interest rate of as the proxy risk-free rate of return. The reason behind using post office interest rate as risk free rate is because Indian investors deposit at least their minimum savings in post office because of the high security associated with post office. Nifty 50 Index is taken as a proxy for market index.

**Findings**

**Sharpe Ratio:** The Sharpe ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Subtracting the risk-free rate from the mean return, the performance associated with risk-taking activities can be isolated.

\[
\text{Sharpe ratio} = \frac{r_p - r_f}{\sigma_p}
\]

**Benchmark:** A benchmark is a standard against which the performance of a mutual fund can be measured. It was made mandatory by SEBI for fund houses to declare a benchmark index from 2012.

**Treynor Ratio:** The Treynor ratio relates excess return over the risk-free rate to the additional risk taken, however, systematic risk is used instead of total risk. The higher the Treynor ratio, the better the performance of the portfolio under analysis.

The following table 1 highlights the portfolio return, Sharpe ratio and benchmark for the selected ICICI Prudential mutual fund schemes for the period of 2017-18 consisting of 12 months.

**Table 1: Sharpe Ratio**

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Avg of pf return</th>
<th>Sharpe ratio</th>
<th>Benchmark</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICICI Prudential Regular Savings Fund - Plan – Growth</td>
<td>0.5449</td>
<td>-0.1947</td>
<td>-0.1332</td>
<td>Under performed</td>
</tr>
<tr>
<td>ICICI Prudential Dynamic Bond Fund – Growth</td>
<td>-3.9234</td>
<td>-0.3016</td>
<td>-0.1332</td>
<td>Under performed</td>
</tr>
<tr>
<td>ICICI Prudential Nifty ETF</td>
<td>32.6033</td>
<td>0.2934</td>
<td>-0.1332</td>
<td>Out performed</td>
</tr>
<tr>
<td>ICICI Prudential Money Market Fund Option-Direct Plan–Growth</td>
<td>9.6913</td>
<td>0.2849</td>
<td>-0.1332</td>
<td>Out performed</td>
</tr>
<tr>
<td>ICICI Prudential Long Term Bond Fund – Growth</td>
<td>-6.4059</td>
<td>-0.2709</td>
<td>-0.1332</td>
<td>Under performed</td>
</tr>
</tbody>
</table>

**Source:** secondary data

From table 1 it is observed that the schemes ICICI Prudential Nifty ETF and ICICI Prudential Money Market Fund Option - Direct Plan - Growth have a positive Sharpe ratio which acts as a positive measure or performance of the schemes in the sample in terms of total risk taken by the investors. Higher Sharpe ratio of 0.2934 is found in ICICI Prudential Nifty ETF and lower Sharpe ratio of -0.3016 is earned by ICICI Prudential Dynamic Bond Fund – Growth. The performance of the schemes are compared with the benchmark index of the market. It is found that out of the 5 schemes selected for the study, 2 schemes has been outperformed when compared with the benchmark of market returns and remaining 3 schemes were underperformed.

**Treynor Ratio:** The following table 2 highlights the Treynor ratio for the selected ICICI Prudential mutual fund schemes taken in the study.

**Table 2: Treynor Ratio**

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Treynor ratio</th>
<th>Benchmark</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICICI Prudential Regular Savings Fund–Growth</td>
<td>-3.0771</td>
<td>0.1413</td>
<td>Under performed</td>
</tr>
<tr>
<td>ICICI Prudential Dynamic Bond Fund–Growth</td>
<td>-2.3985</td>
<td>-0.5858</td>
<td>Under performed</td>
</tr>
</tbody>
</table>
Conted…

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Unsystematic risk</th>
<th>Systematic risk</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICICI Prudential Nifty ETF</td>
<td>-2.3139</td>
<td>-0.5858</td>
<td>Under performed</td>
</tr>
<tr>
<td>ICICI Prudential Money Market Fund Option - Direct Plan – Growth</td>
<td>-2.1880</td>
<td>0.0892</td>
<td>Under performed</td>
</tr>
<tr>
<td>ICICI Prudential Long Term Bond Fund – Growth</td>
<td>-2.0994</td>
<td>-0.5858</td>
<td>Under performed</td>
</tr>
</tbody>
</table>

Source: secondary data

It is evident from the above table that all the schemes have a negative Treynor ratio which acts as a negative performance of the schemes in the sample in terms of systematic risk taken by the investors. A fund with a higher Treynor ratio implies that the fund has a better risk adjusted return than that of another fund with a lower Treynor ratio. Highest Treynor ratio of -2.0994 is found in ICICI Prudential Long Term Bond Fund - Growth plan which offers a better risk-reward equation for the investor and Lowest Treynor ratio of -3.0771 is grabbed by ICICI Prudential Regular Savings Fund - Plan - Growth Plan which shows less risk adjusted return among the five schemes selected for the study. The performances of the schemes are compared with the benchmark index of the market. It is found that all the five schemes selected for the study has been underperformed.

Risk: The following table 3 highlights the unsystematic and systematic risk for the selected ICICI Prudential Mutual Fund schemes taken in the study.

<table>
<thead>
<tr>
<th>Schemes</th>
<th>Unsystematic risk</th>
<th>Systematic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICICI Prudential Regular Savings Fund - Plan – Growth</td>
<td>0.6678</td>
<td>0.0423</td>
</tr>
<tr>
<td>ICICI Prudential Dynamic Bond Fund – Growth</td>
<td>15.2488</td>
<td>1.9172</td>
</tr>
<tr>
<td>ICICI Prudential Nifty ETF</td>
<td>108.8301</td>
<td>-13.7985</td>
</tr>
<tr>
<td>ICICI Prudential Money Market Fund Option - Direct Plan – Growth</td>
<td>31.6530</td>
<td>-4.1208</td>
</tr>
<tr>
<td>ICICI Prudential Long Term Bond Fund – Growth</td>
<td>26.1433</td>
<td>3.3728</td>
</tr>
</tbody>
</table>

Source: secondary data

A higher standard deviation i.e., unsystematic risk characterize that the returns of the fund have been more unstable and risky than fund having lower standard deviation. From the above table it is clear that, highest standard deviation of 108.8301 is found in ICICI Prudential Nifty ETF stating instability of the fund. The systematic risk i.e., beta value is less than 1 in the schemes as ICICI Prudential Regular Savings Fund - Plan – Growth, ICICI Prudential Nifty ETF and ICICI Prudential Money Market Fund Option - Direct Plan - Growth indicating less risky return than the market return. Highest beta value of 3.3728 is found in the scheme ICICI Prudential Long Term Bond Fund - Growth which has the highest volatility and lowest beta value of -13.79 is found in ICICI Prudential Long Term Bond Fund - Growth plan which has low volatility.

Conclusion

In this study performance of five ICICI Prudential Mutual Fund Schemes were examined for the period between April 2017 to March 2018. Out of the 5 schemes selected for the study, ICICI Prudential Nifty ETF schemes have the highest return. The performance of the selected schemes was evaluated using Sharpe ratio and Treynor ratio. It was concluded that ICICI Prudential Nifty ETF schemes and ICICI Prudential Money Market Fund Option - Direct Plan - Growth schemes has outperformed the market and are risk borne when compared to other schemes.5

Ethical Clearance: Completed

Source of Funding: Self

Conflict of Interest: Nil

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Human Papilloma Virus-Oral Perspective

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ABSTRACT

The oral cavity is a common site for human papillomavirus (HPV) infection, however much is still unknown about the spectrum of oral lesions associated with HPV. HPV is associated with a variety of clinical conditions that range from innocuous lesions to cancer. HPV types are divided into high and low-risk types, according to the oncogenic potential. Molecular and epidemiologic studies have identified the association between high-risk HPV types (especially HPV-16 and HPV-18) and oral potentially malignant and malignant lesions. Although HPV is one of the etiologic agent of oral cancer, it is not a single contributing factor and a variety of factors contribute to the cancer development. Risk factors include smoking, panchewing, alcohol consumption.

Keywords: Human papilloma virus, Potentially malignant oral diseases, Oral cancer

Introduction

Human Papillomaviruses (HPVs) are a group of DNA viruses, which have a remarkable target cell specificity: reported principally in anogenital tract, urethra, skin, larynx, tracheobronchial mucosa and oral cavity. More than 100 different types of HPV have been classified and they are divided into high oncogenic risk genotypes (16, 18, 31, 33, 35, 58) and low oncogenic risk genotypes (2, 4, 6, 11, 13, 32) depending on their association with malignant change. Specific HPV subtypes from both high and low risk groups are associated with epithelial lesions found on the skin and mucosa.

The HPV Genome: The HPV viral genome is non-enveloped, circular and has an approximate size of 8Kb. The viral genome is transcribed from a single strand of viral DNA, which consists of 8 open reading frames (ORFs). The genome contains 3 main parts; the early region (E), late region (L) and a non-coding long control region (LCR). The E region encodes viral proteins E1-E7, which control the transcription of viral DNA, while the L region encodes viral proteins L1 and L2, which control assembly of the virion and viral spread. The replication factors E1 and E2 are amongst the first viral proteins that are produced and are thought to be responsible for regulating the replication and transcription of viral DNA. It is thought that E4 and E5 are involved in the regulation of late viral functions, however their exact role remains unknown. E6 and E7 target the host proteins pRb and p53, which regulate progression through the cell cycle.

The HPV Life Cycle: HPVs demonstrate selective affinity for keratinocytes, infecting the basal and parabasal cells of squamous epithelium. It is most likely that the virus gains access to basal cells via microscopic breaks in the mucosa. The life cycle of HPV is closely associated with the differentiation of epithelial cells, and production of mature viral particles only occurs in terminally differentiated keratinocytes. In order for the virus to continue replicating in a differentiated cell which contains little to no replicative machinery, the virus expresses proteins early in infection in the basal epithelial compartment, which stimulates G1 to S phase progression.

Prevalence of Oral HPV Infection in the General Population: Detection of HPV requires epithelial samples that can be obtained by tissue biopsy or exfoliated epithelial cells. Oral HPV detection is
accomplished by the examination of exfoliated cells collected by direct swabbing or in oral rinse or saliva samples. Because of the ability to collect exfoliated cells over a larger area, oral rinsing is considered to be the most sensitive method for oral HPV detection, however it is unknown how behavioural factors such as recent food consumption and oral hygiene may influence the detection of HPV. Prevalence rate ranging from 0-70% in cervical mucosa12,13. Larger population based studies, however, estimate that the overall prevalence of HPV in the oral mucosa in normal individuals is approximately 5-10%, which is substantially lower than in the cervix14,15.

**HPV Detection Methods**

**Low Sensitivity: Immunohistochemistry and in situ hybridization** - because they only detect the virus when it is present in more than 10 copies of the viral DNA per cell.

**Moderate Sensitivity: Southern blot, dot blot and reverse dot hybridizations** - because they only detect the virus when present in 1 to 10 copies of the viral DNA per cell.

**High Sensitivity: PCR** - because it detects the virus in less than 1 copy of the viral DNA per cell16.

**Human Papillomavirus Prevalence in the Oral Cavity and Oropharynx:** In the normal oral mucosa HPV rates detected, from 22% to 60% from 0% all the way to 81.1% in studies using different methods, and with a limited number of individuals, and this seems to depend on the population studied and the choice of method. Oral and oropharynx squamous cells papilloma are benign tumors that occur mainly between 30 and 50 years of age, although they may also occur below 10. They usually involve the soft palate, tongue, frenulun linguae and the lower lip. In most of the cases, the papillomas are single and small (<1cm)24. They have an exophytic growth and show up both as a broad based ovoid bulging or a pedicled lesion. The surface may present small finger-like projections, giving it a rough verruca contour. The color varies from white to pinkish, depending on the levels of keratinization and vascularization16.

**Oropharynx and Oral Condiloma Acuminata:** Oral condiloma acuminata is usually considered a sexually transmitted disease, acquired by oral sexual contact but may also be transmitted by self inoculation or maternal transmission. In the mouth they are usually present as small pinkish or whitish nodules. They occur alone or in multiple form, frequently on the tongue, lip, palate and floor of the mouth. The human papillomavirus was detected in condilomatous oral lesions, initially by immunohistochemistry, and later by hybridization techniques, with a positiveness varying between 75% to 85% for HPV 6 and 1117.

**Oral and Oropharynx Common Wart:** The common wart is one of the most common skin lesions, specially in children. They are frequently located on the lips, hard palate, gums and tongue dorsum. They observed a variation in the HPV detection rates from 43% to 100% in oral warts18,19.

**Oral Focal Epithelial Hyperplasia (FEH):** The term focal epithelial hyperplasia or Heck’s disease is a benign lesion located in the oral mucosa, tongue and most notably in the lower lips19. It is clinically characterized by multiple painless and soft papules, of color that varies between pale pink and the normal mucosal color. Viral etiology has been initially shown by Immunohistochemistry and later on by hybridization techniques identifying HPV 13 and 32, which were detected in 75-100% of the cases20.

**Human Papillomavirus Prevalence in Oral Cancer and Oropharynx:** Unfortunately, oral cancer still bears high mortality rates. Its incidence rate varies from one region to another, being high in India, Sri Lanka, Vietnam, Filipinas, Hong Kong and Taiwan, where about 30% of all the cancers occur in the oropharynx2. Oral cancer includes malignant neoplasms in the lips, oral cavity and oropharynx. Cigarette smoking and alcohol are the main causes of oral cancer. However, part of the population develops oral cancer without having been exposed to these risk factors, suggesting other causes, such as: genetic predisposition, diet and viral agents, most specifically HPV. HPV role as an etiological agent in the oral cancer is less than that from alcohol and tobacco use. Many studies have shown HPV 16 to be the most prevalent type in oral cancer. According to many studies, the HPV prevalence rate in oral cancer varied from 0-100%21. One of the greatest difficulties in identifying HPV in oral cancer patients is the presence of this virus in only one subpopulation of cells and the reduced number of copies of these cells which are infected. That is why we need high sensitivity detection methods.
Verrucous Carcinoma: The verrucous carcinoma was first described as a variant of the squamous cells carcinoma, which originates in the oral cavity. Also known as Ackerman’s tumor, its growth is exophytic, slow and invasive only superficially, with a low metastasis rate, and it may be treated with simple excision. Many authors have reported the HPV presence in the verrucous carcinoma.

Discussion

HPV prevalence in the oral cavity and oropharynx is considered uncertain, because many studies have shown different results with the estimate of a small number of patients, and a modest identification among the different types of HPV found in mucosal lesions. HPV diagnosis in the oral mucosa and the oropharynx may be suspected by the clinical exam of the lesion, cytology and biopsy; however the molecular biology exams are the ones able to detect the HPV DNA in the cell, stressing the polymerase chain reaction as the most sensitive method to detect HPV. The assessment of different methods used to detect HPV16 is important and fundamental in order to establish the etiological role of HPV in oral lesions. Other factors that contribute to increase HPV prevalence in the oral cavity and oropharynx are reduction in the patient’s immune response for the virus, having more than one sexual partner and the practice of oral sex these all increase the likelihood of an HPV infection and its recurrence.

Conclusion

Human papillomavirus infection, high or low risk, is not a common finding in oral cavity. High risk HPV types are associated with high grade oral epithelial dysplasias with characteristic histopathologic features, which preferentially affect the floor of the mouth. Low risk HPV may be helpful in identifying atypical papillary lesions that are unlikely to show potentially malignant behaviour. Malignant papillary lesions are large and locally destructive, but rarely result in death from disease.

Source of Funding: Self

Conflicting Interest: Nil

Ethical Clearance: Not needed as it as a review article

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The Mounting Horizons of Corporate Criminal Liability

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ABSTRACT

Corporations play a significant role not only in creating and managing business but also in common lives of most people. A living person has a mind and body which can have knowledge or intention or be negligent and he has hands to carry out his intentions. A corporation has none of these; it must act through living persons, though not always one or the same person. The corporate criminal liability is like a parasite which is detrimental and unsafe and can cause harm any time to the company as well as to the society (public at large). It needs a host like the parasite to spread its influence and in the case of corporate criminal liability the directors, officers or managers plays the role of the host. This article is an attempt made by the author to reflect the concept of corporate criminal liability and its impact on the society.

Keywords: Corporation, corporate criminal liability, offence, society

Introduction

“A company can only act through human beings and a human being who commits an offence on account of or for the benefit of a company will be responsible for that offence himself.”

—Glanville Williams

Corporations play an important role not only in constructing and running business but also in common lives of most people. That is why most modern criminal law systems anticipate the possibility to hold the corporation criminally liable for the perpetration of a criminal offence. With the increasing role of large multinational corporations in the world economy today and the growing figure of India as a favored worldwide investment destination, the nature and extent of corporate criminal liability in India definitely assumes a unique significance.

It has been rightly said, “Many weeds have grown on the acre of jurisprudence which has been allotted to the criminal law. Among these weeds is a hybrid of vicarious liability, absolute liability, an inklings of mens rea—though a rather degenerated mens rea, a few genes from tort law and a few from the law of business associations. This weed is called corporate criminal liability. Nobody bred it, nobody cultivated it, and nobody planted it. It just grew. To be quite sure, it has not done much harm; at least nobody has established any harmful results stemming from its mere existence, so that some may well wish to conclude upon its usefulness. Has it done good? Nobody knows, though the farmers of the law have formed many opinions, all resting on rather educated agronomic conjecture.”¹ But the weed of Corporate Criminal liability is identified and need to be addressed in the present scenario as it is gaining momentum in the era of globalization.

Corporate criminal Liability refers to the imposition of criminal liability on the corporation through its employees and agents. Or it can be defined as illegal act of omission or commission, punishable by criminal sanction committed by individual or group of individual in course of their occupation. The corporate criminal liability is the liability imposed upon a corporation for any criminal act done by its employee. Liability is imposed on the corporation in order to regulate the acts and affairs of the corporation.²

Corporate criminality can be even defined as publicly harmful acts which represent a kind of instrumentalities

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committed in course of occupations by people who are in a position of managing and are responsible for the affairs of the company. “Corporate criminal Liability refers to the imposition of criminal liability on either the corporation or its employees and agents”. A corporation neither has soul nor body, and it cannot act like a real man. Whatever interests, rights, property a company possesses in law in fact is actually held and managed by the shareholders or directors because every legal or juristic person have some natural persons as their agents and representatives to act on their behalf.3

Objective

The purpose of research in this topic of corporate criminal liability are:

1. To know whether the corporations are entitled to punishment, even if they are legal entities and juristic persons.

2. To know whether there are sufficient provisions provided in the statutes which can regulate this criminal liability of corporation.

3. To know how the Indian Judiciary is tackling these types of cases relating to corporate criminal liability.

Jurisprudence of Corporate Criminal Liability:

Corporation is a legal fiction created by the law to act like a human being in several respects though it is incapable of performing certain physical and emotional acts peculiar to the human body and mind. Although the companies are not exactly similar to a natural person, but, the actions of a corporeal person, the conducts of the corporation have consequences.5

“A company cannot be guilty of any criminal offence which, by their very nature, can only be committed by natural persons (such as bigamy), nor of those which cannot be committed vicariously (such as perjury, bigamy, rape, homicide, etc.). A company cannot be indicted for a crime where the only punishment is death or imprisonment. A company may be guilty both of statutory and common law offences, even though the latter involves mens rea. A corporation can be indicted for contempt and libel”.6 In criminal law, the basic rule is actus non facit reum, nisi mens sit rea which means one has to prove the act done which was forbidden by law has been done with guilty mind. So, every crime has two elements one physical known as actus reus and other mental known as mens rea. As per the fundamental rule of criminal liability, the guilty mind or Mens Rea has to be proved but it sounds odd in case of corporations, because they are not human beings. However, corporations are handled, created and managed by human beings known as directors, officers or managers. So, if any company or corporation is criminally held liable then it will hold the persons liable who are responsible for the given work. Corporate liability determines the extent to which a corporation as a fictitious person can be liable for the acts and omissions of the natural persons it employs.7 Under Section 305 of the Code of Criminal Procedure, it provides there will be a representative appointed on behalf of the corporation for purpose of inquiry, trial and appeal.

The major law relating to Corporations in India is codified in The Company Act, 1956 and the definition of Corporation as given in the Act under Section 2 (7) includes a company. In India, liability of the corporation is basically liability of the company only as it is a creation of law. It is not a human being but an artificial person so when a company is incorporated than the human beings will take the responsibility and on the behalf of the company they will get punishment however it is difficult to analyze whether the corporations can be held liable because corporations cannot have the mens rea or the guilty mind to commit an offence and corporations cannot be imprisoned. Corporation is a body that is granted a charter, recognizing it as a separate legal entity having its own rights, privileges and liabilities distinct from those of its members.8
Theories of Corporate Criminal Liability:

Agency: It is based on the agency principle whereby the company is liable for wrongful acts of all its employees. As from Torts we know that the Master is liable for the work of agent according to the vicarious liability principle. US federal law employs a principle of this type, respondeat superior, while English law confines the application of vicarious liability to certain regulatory offences. It seeks to equate corporate culpability which that of an individual and therefore derivative forms of liability.9

Attribution: The Second theory of blame, which English law utilises for all other offences, identified a limited layer of senior officers within the company as its brains and renders the company liable only for their transgressions, not for those of other workers. It adopts an anthropomorphic vision of company decision-making.10

Alter Ego (Identification): In the middle of twentieth century, the English Law considered a form of corporate liability that could apply to serious offences such as fraud, theft and manslaughter. The English judges stipulate more of a showing of a direct connection between the company and the person responsible for the criminal harm than is provided by theories of vicarious liability.11 Granville Williams had drawn a division that lowly company employees were declared to act as the hands while directors and officers represent the brains of the company. The identification doctrine is insufficient to deal with the reality of decision-making in many modern companies. Several alternative methods for the establishment of corporate culpability have been introduced.12

Development of Corporate Criminal Liability in India: It is pertinent to understand the development of corporate criminal liability in India. The criminal law in India has developed as a method for taking action to individual wrongdoing. Individuals as independents are free to control their actions, to think and make decisions, including the choice to do wrong. Consequently, such persons can be held liable for those choices and can be blamed and punished for them. The individualistic idea of accountability does not logically include artificial organizations such as companies.

If observed, “it can identify that much of our lives today is affected by companies: we work for them (in conditions that might be dangerous); we purchase their products (that might explode or poison us); we travel in their ferries and trains (that might be unsafe); we drink the water they provide (which might be unclean) and we breathe the air (into which they might have emitted their fumes). So, in short, companies can kill or injure us. But can they be held criminally responsible is the main question.”13

In India there is no particular law or act which deals with the law relating to corporate criminal liability. The law on this point is not confined to the general criminal law as provided in the penal code but it is in fact scattered over a plethora of statutes with specific provisions for the same.14

“Section 2 of the Indian Penal Code 1860 provides that every person shall be liable to punishment under the Code. Section 11, as is common in common law countries, defines a person as including ‘any Company or Association or body of persons, whether incorporated or not’. Section 11 of the Indian penal code defines person to include any company or association or body of persons incorporated or not. Indian courts have inherited the identification approached from England”.

“The Companies Act, 1956, also imposes criminal liability on companies as well as on the directors and other officers of the company. A perusal of the following sections under the Companies Act,1956 indicate thus-

1. Section 59 provides that if any prospectus is issued in contravention of section 57 or section 58, the company and every person who is knowingly a party to the issue shall be punishable with fine.

2. Section 108I (4) (b) mandates that if any company gives effect to any voting or other right exercised in relation to any share acquired in contravention of the provisions of section 108B or which gives effect to any voting right in contravention of any direction made by the central government under section 108D, the company shall be punishable with fine

3. Section 142 provides that if default is made in filing with the registrar for registration the particulars (a) of any charge created by the company (b) of the payment or satisfaction of a debt in respect of which a charge has been registered under this part (c) of the issue of debentures of a series; requiring registration with the registrar under the provisions of this part, then, unless the registration has been
effected on the application of some other person, the company and every officer of the company who is in default shall be punishable with fine.”

The drafters had inserted Section-86 in Companies Act, 2013 which provides “punishment for contravention- if a company contravenes any provision of the companies act, then the company shall be punishable with fine which may extend to 10 lakhs from 1 lakh and every officer of the company who is in default shall be punishable with imprisonment for a term which may extend to 6 months.”

*Standard Chartered Bank and Ors. v. Directorate of Enforcement*[2005) 4 SCC 530]

This is the landmark case in which the apex court overruled all the previous laid down principles. In this case, Standard Chartered Bank was being prosecuted for violation of certain provisions of the Foreign Exchange Regulation Act, 1973. Ultimately, the Supreme Court did not apply the literal or strict interpretation rule for penal statutes and held that the corporation could be prosecuted and punished, with fines, regardless of the mandatory punishment required under the respective statute.

In *Iridium India Telecom Ltd. v. Motorola Incorporated and Ors*[AIR 2011 SC 20 ], the apex court held that a corporation is virtually in the same position as any individual and may be convicted under common law as well as statutory offences including those requiring mens rea. In Iridium, the Supreme Court held: “The criminal liability of a corporation would arise when an offence is committed in relation to the business of the corporation by a person or body of persons in control of its affairs. In such circumstances, it would be necessary to ascertain that the degree and control of the person or body of persons is so intense that a corporation may be said to think and act through the person or the body of persons.” The notion that a corporation cannot be held liable for the commission of a crime had been rejected by adopting the doctrine of attribution and imputation.

The Supreme Court recently in *Sunil Bharti Mittal v. Central Bureau of Investigation (“CBI”) and Others* held that the “principle of alter ego can only be applied to make the company liable for an act committed by a person or group of persons who control the affairs of the company as they represent the alter ego of the company; however it cannot be applied in reverse direction to make the directors of the company liable for an offence committed by the company.”

**Conclusion**

The corporations currently play such a pivotal role in everyday life and wield such enormous powers and so many of them have been recently involved in serious misconduct. The corporate criminal liability is like a parasite which is detrimental and unsafe and can cause harm any time to the company as well as to the society (public at large). It needs a host like the parasite to spread its influence and in the case of corporate criminal liability the directors, officers or managers plays the role of the host. It is frequently argued that a company cannot act except through real persons like directors, officers and employees. Although in the past there was a view that the companies cannot prosecuted for offences attracting mandatory punishment of imprisonment and fine, as imprisonment cannot be enforced but as of now the rule has been changed and now Supreme court held that company should not be allowed to escape from its technicality. The concept of corporate criminal liability is evolving more through the judicial analysis then the legislative changes in the law.

**Ethical Clearance:** Not required, as the article is based on aspects which are doctrinally taken.

**Source of Funding:** Self

**Conflict of Interest:** Nil

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A Study of Prevalance of Thyroid Dysfunction in Pregnancy in a Rural Hospital of Uttar Pradesh

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ABSTRACT

Thyroid dysfunction is the 2nd most common endocrine disorder in women of childbearing age affecting two generations. There is no clear data available for rural areas of this sub-Himalayan zone, once with a known endemicity for iodine deficiency. A total of 300 pregnant women attending antenatal OPD of a tertiary care centre (SIMS, Hapur) in rural western UP, at their first visit, were enrolled for study. Epidemiological & clinical details were recorded and thyroid screening test (TSH) done after confirmation of pregnancy. Patients were followed up until delivery.

Out of the 300 patients enrolled, 20 were excluded and 280 were finally analysed. As per trimester specific reference range for TSH, patients were categorised into 3 groups. Euthyroid (n=233, 83.2%), Subclinical (n=43, 15.3%), and overt Hypothyroid (n=4, 1.4%) groups. Subclinical hypothyroidism detection rate was a little higher (17.6%) in 2nd trimester than elsewhere while overall prevalence was 16.8%. The rates of prevalence of Hypothyroidism in the pregnant population in our study confirms largely with data from other studies in the region

Keywords: Thyroid dysfunction, Pregnancy, Rural

Introduction

Universal salt iodisation in India was implemented all over India by 1992 under National Goitre Control Programme, 1962 (Modified to NIDDCP, 1992) which brought a revolution in management of thyroid disorders in form of drastic decrease in prevalence of goitre especially in sub-Himalayan belt but, even years after that, prevalence in Indian pregnant women is still high & masked by other common medical disorders of pregnancy. In pregnancy, thyroid disorder is the second most common endocrine disorder after Diabetes Mellitus that affects health of two generations (¹,²).

In pregnancy, thyroid gland undergoes wide adaptation in both size & synthesis of thyroid hormone as per increased demands of body metabolism. Thyroid gland may enlarge by 10% (in iodine sufficient area) or more (in iodine insufficiency areas)³, whereas, production of thyroid hormones and iodine requirement each increases by approximately 50% to combat it⁴.

This study was designed to find the prevalence of hypothyroidism in child bearing age in women during pregnancy irrespective of period of gestation, in rural areas of western part of Uttar Pradesh. This was a hospital based observational study.

Method

The study was conducted from March 2017 to February 2018 after approval from institutional ethical committee.

A total of 300 women attending antenatal OPD at Saraswathi Institute of Medical sciences, Hapur, a tertiary care hospital in rural area of western UP, were enrolled for the study at their first visit, after taking informed consent, irrespective of gestation. Epidemiological & clinical details were taken after confirmation of pregnancy. Detailed obstetric, menstrual, personal, family history and past history of thyroid medication or thyroid surgery & clinical examination were recorded using a predesigned proforma. Thyroid screening (TSH) was done along with routine investigations.
Under aseptic precautions, 3ml of venous blood was collected in morning hours after overnight fasting and processed in central pathology lab at SIMS, Hapur. TSH levels were compared with trimester specific reference range (ATA, 2011). Abnormal values were further sampled for FT4 & thyroid antibody (TPO) in a NABL accredited laboratory.

### Statistical Analysis

The data was entered in excel sheet & percentages of various outcome measures were calculated & statistical analysis was done by using SSPS software (20.0 version). Relevant statistical test was applied and statistical significance was determined.

### Results

300 pregnant women in all three trimesters were screened for TSH level. 20 cases were excluded from the study due to previously known thyroid dysfunction, on thyroid supplements. Out of 280 patients, 80 patients in 1st trimester, 147 in 2nd trimester and 53 in 3rd trimester were analysed for study.

A total of 280 patients attending the ANC OPD at this hospital were evaluated during the study. The total number of patients were divided into 3 groups as per trimester specific reference range for TSH. The incidence specific prevalence of Thyroid status has been enumerated vice Table-2. The prevalence of the disease in the study group is summarized as – Euthyroid patients (n=233, 83%), Subclinical Hypothyroidism (n=43,15.3%), and Overt hypothyroid patients (n=4, 1.4%). The majority of patients reported during the 2nd Trimester of pregnancy (n=147, 52.5%), whereas, only 80 patients (28.5%) reported during the 1st trimester. A significant number of patients (n=53, 18.9%) still continue to report first during the 3rd trimester.

### Discussion

This study was aimed at evaluating thyroid function during pregnancy in Rural areas of western part of Uttar Pradesh (UP). Important findings are that overall 16.8% women attending tertiary care hospital have abnormal thyroid function in pregnancy, out of which, majority (91%), have subclinical hypothyroidism.

After wide acceptance of guidelines by ATA & National association of clinical biochemist (NACB) about the upper limit of normal TSH during pregnancy (2.5 mIU/ml in 1st trimester & 3.0 mIU/ml in 2nd & 3rd trimesters) (5, 6), there was major concern about updated prevalence of thyroid dysfunction in pregnancy in different zones according to these changes. Majority of previous studies have reported the normal adult cut-off levels of upper limit of TSH as 4.5mIU/ml, so, updated prevalence will be definitely higher.

Our findings are consistent with the study done by Jaya et al., where the rate of prevalence was 14.2% and also similar with another report done by Dhanwal et al., who reported 14.3% women in their 1st trimester to be having hypothyroidism.

Another multicentric study across India enrolling 2599 pregnant women depicts overall prevalence of 13.13%, majority being subclinical which is comparable with our results.

A cross-sectional study conducted in central UP (Lucknow) by Parveen S et al., showed prevalence of 14.7% with slightly high prevalence (16.7%) in 25-30 yrs age group pregnant women, this, almost equalising our result. The study done by Kalra et al., showed that 15.7% pregnant women were suffering from hypothyroidism in North India.
TPO level assessment could not be done in all patients when needed, as it had to be outsourced to another centre (affordability by the patients being the predominant issue) and that once the thyroid dysfunction was detected and treated, subsequent TSH levels after treatment initiation could not be analysed post-delivery due to loss of follow-up by patients.

Conclusions

Most relevant point in our study was that it was conducted on population in rural areas which were relatively deprived of latest diagnostic aids, a facility easily available in even the remote location of centres in urbanized areas.

According to our study, subclinical hypothyroidism detection rate was a little higher (17%) in 2nd trimester than 1st trimester. The rates of prevalence of Hypothyroidism in the pregnant population in our study confirms largely with other studies in the region.

If untreated, subclinical hypothyroidism leads to adverse effects on pregnancy outcome. Early diagnosis & treatment is helpful in preventing the complications e.g. miscarriage & stillbirth, if the patient is routinely advised thyroid function tests during her first prenatal visit or soon after the pregnancy is confirmed.

Future Prospects: All pregnant women should be screened for thyroid disorder with trimester specific reference range as a part of universal screening in our country in view of high prevalence of undiagnosed cases. Most cases of subclinical hypothyroidism resolve soon after pregnancy, treatment with L-thyroxin should be reviewed in postpartum period.

Thyroid function test must be performed during subsequent pregnancy in affected women even though resolved in the interim postpartum period.

Source of Funding: No funding sources were utilized.

Conflict of Interest: None declared

Ethical Approval: The study was approved by the Institutional Ethics Committee

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Facial Esthetic Correction Using Cheek Plumper and Cross-Arch Occlusion Concept in Skeletal Class III Complete Denture Patient—A Case Report

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ABSTRACT

Esthetic factor not only confined to teeth but also to be considered for facial appearance. Facial esthetic may be compromised due to lack of support from the internal structures i.e. teeth, ridge, muscles etc. This results in slumped or hollow cheek proving detrimental to facial esthetics. Cheek plumper help to enhance facial appearance by supporting the slumped cheeks. Variance of arch form and arch size in the same mouth may be due to continuous resorption of the maxilla and the mandible. Also varying degrees of closure of the jaw alter the ridge relations. These alterations in ridge relations may cause a unilateral or bilateral “cross-bite” relation in the posterior segments of the arch. This complicates the denture fabrication in conventional manner. The purpose of this case report is to present a simple technique for correction of facial esthetics using cheek plumer and bilateral cross arch occlusion concept.

Keywords: Cheek plumer, Cross arch occlusion, Skeletal asymmetry, Facial esthetics, Cross bite

Introduction

Transforming conventional into unconventional approach is a characteristic feature of evergrowing prosthodontics branch. The increasing demand of patients and revolutionary thought of prosthodontists have led to the outcome of the special, i.e. the unconventional approach for fabricating complete dentures. Teeth setting done in conventional manner1 proves satisfactory in most of the patients, but uncompromised patients, conventional method brings with it certain disadvantages. So starring new techniques based on same old fundamentals of prosthodontia is known as the unconventional complete dentures, a manifestation of new vision in prosthesis construction.

Cheeks are an important part of human facial esthetics due to their prominent visibility. Factors like extraction of molars, thinning of tissues due to aging, facial paralysis may lead to hollowing of the cheeks. This can make a person appear prematurely older and hence have a negative psychological impact on the patient.2-3 There are many techniques like reconstructive plastic surgery with facial implants, or malar augmentation with injectable materials. But, prosthetic rehabilitation is a preferred treatment option, when due to medical or other reasons a surgical approach is contraindicated.4-5

Complete edentulism in patients with skeletal class III deformities complicates the situation and opposes clinical challenge. Skeletal class III deformities are caused by maxillary deficiency, mandibular excess, or a combination. Approximately 40% of class III deformities are caused by maxillary deficiencies alone.6

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In a normal relation between upper and lower edentulous jaws, the outlines of the crest of the upper and lower ridges are similar and approximately coincident although separated in a vertical plane. Unfortunately when ridge relations are abnormal, they do pose a challenge in modifying the normal guidelines to fulfill all demands. Abnormalities in jaw relations exist mainly in two forms: (1) maxillary protrusion and wider upper arch and (2) mandibular protrusion and wider lower arch.

Nicholls stated that, “If lines were drawn from the crest of the mandibular ridge to the crest of the maxillary ridge at the location of the mandibular second molar, they would incline at an angle of 83 to 80 degrees to the hypothetical occlusal plane drawn at right angles to the medial line. These lines are called the interalveolar crest lines”, the arrangement of teeth in normal occlusion would be possible. Deviations from this average inclination would necessitate modifications.

In 2005, there was renewed interest in specific artificial teeth for cross bite tooth setup for complete dentures among some manufacturers. These teeth sets are usually expensive, and complete denture patients usually present with poor economic background. This case report present a simple and inexpensive technique to correct facial esthetics using cheek plumper and cross arch occlusion in a patient with atrophied maxillary arch and wide mandibular arch.
Case Report

A 62 year old male patient came in the Department of Prosthodontics and Implantology in Himachal Institute of Dental Sciences with the chief complaint of inability to chew. On clinical, extra oral examination, the facial profile was Angle's Class III and facial form was tapering (Fig. 1). The patient exhibited impaired muscle tone and function. Neuromuscular coordination was fair. Length of the lip was long. On clinical examination, maxillary ridge were square to gently rounded and mandibular ridges were inverted “U” shaped. Interarch space was ideal to accommodate the artificial teeth. Lateral throat form was class II and palatal throat form was also class II. Quantity and quality of saliva was adequate and normal. There was no such relevant history for facial asymmetry. To diagnose facial asymmetry, PA view, TMJ view, OPG was advised. On radiological examination it was seen that there was no pathology in the Temporomandibular joint, but the gonial angle of the left side of the mandible is slightly down as compared to the gonial angle on the right side of the mandible as seen in OPG view (Fig. 2). Also there is condylar hyperplasia on the left side of the mandible as seen in TMJ view (Fig. 3). Gross facial asymmetry was noticeable in Posteroanterior view (Fig. 4). Treatment was planned keeping in mind the expectations of the patient. Case was started with the conventional primary impression making using impression compound followed by secondary impression making using Zinc Oxide Eugenol paste. Jaw relation was recorded and then transferred to semi adjustable articulator using facebow transfer (Fig. 5). The jaw size discrepancy clearly precludes an efficient occlusal scheme if artificial teeth are setup in the conventional bite relationship. Commercially available artificial teeth in a cross-inverted manner were mounted. During trial patient was very much concerned of his hollow cheek unilaterally. So we incorporated cheek plumper in trial denture on the buccal surface of the denture (Fig. 6). Patient appreciated it very much. The denture was acrylised in conventional manner. After finishing and polishing prosthesis was delivered to the patient (Fig. 7-8). Patient was recalled after 24 hours for followup. Patient was very much satisfied with the appearance and functionality of the denture.

Discussion

In present case report, jaw deviation towards the right side gives hollow cheek appearance. To overcome this problem cheek plumper was attached buccally, on the right side of the maxillary denture to give more pleasing appearance to the patient. As the lower arch was too wide and cannot be managed otherwise during occlusal scheme development, an interchange was accomplished by using upper teeth on the lower denture and lower teeth on the upper denture. Also the interchange was made across the arch as well. Thirteen upper teeth were placed on the left lower ridge, and left lower teeth were placed on the right upper ridge. Similarly, the left upper posterior teeth were set on the right lower ridge, and right lower posterior teeth were placed on the left upper ridge. Special tooth mould (K-mould from Ivoclar) are available now a days for cross arch arrangement of teeth. In this case report to overcome economic barrier for the patient, teeth set from Ruthinium two chromatic layers (0020003 Acry Rock V. Set 28 Teeth) was used.

Conclusion

This case report proposes a simple, effective and non-invasive technique by using cheek plumper as an alternative method to improve facial appearance in a patient with hollow cheek and deviated jaw. With this technique, patient’s appearance masticatory function and also self-confidence was improved.

Ethical Clearance: Taken from Institutional Ethical committee

Source of Funding: Self

Conflict of Interest: Nil
REFERENCES


Study Design for Establishing Diagnostic Reference Levels and Optimization of Radiation Dose for Head and Neck and Pelvic Computed Tomography Protocols in Radiation Therapy Planning

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ABSTRACT

Aim: To establish Diagnostic Reference Levels and optimization of radiation dose of head and neck and pelvic imaging in pre Radiation therapy planning computed tomography (RTCT).

Objective: To establish Diagnostic reference level for Head & Neck CT and Pelvic Computed Tomography in radiation therapy planning and to optimize radiation dose to the cancer patients undergoing Head & Neck and Pelvic Computed Tomography scans.

Methodology: This study will be divided into two phases. In phase one, Diagnostic reference Level will be established using standard CT Oncology protocol and arriving optimized protocol using phantom. In phase two, optimized protocol will be tested on patient population and image quality will be analyzed subjectively and objectively.

Outcome: Expected outcome would be to establish diagnostic reference level for optimized radiation dose protocol and Reduction in radiation dose in optimized dose protocol in comparison with existing dose protocol for CT Head & Neck and pelvis without compromising image quality.

Keywords: Radiotherapy, CT localization, Diagnostic reference levels, Head and neck, Pelvis

Introduction

At present CT image acquisition is the standard procedures in the clinical treatment planning process in Radiotherapy Planning for all cancer cases. Both tumor and normal tissue images are acquired during procedure. This imaging method is results in radiation doses and carries a cancer risk. Radiological safety concerns very much addressed in radiology to restrict subsequent probability of malignant tumors. Other than therapeutic radiation, exposures are ruled by the principle “as low as reasonably achievable”, with Radiotherapy Planning CT simulation lies in the bracket. Hence, it becomes essential as radiation exposure to the participant follows the principle.(1)

During CT imaging for Radiotherapy Planning purpose, a quality image must be obtained with optimizing the dose to the patients. Dose in CT generally depend on the choice of technical factors that are used to perform CT examinations. By varying some of the factors in CT control panel the dose to patient who is undergoing CT scan will vary. For example, of the technical factors milli amperage seconds (mAs) which is the combination of tube current and slice scan time,
tube peak kilo voltage (kVp), pitch in multi-slice, rotation time, CT slice thickness, and filtration. Because of this the concept of Diagnostic reference level for imaging procedure is implemented by ICRP by 1996 to optimizing the radiation dose to the patients.

By using suitable protocols of CT imaging which depends on the factors like region of examination, patient size the dose can be optimized under the principle as low as reasonably achievable. There are already DRL for diagnostic CT of adult patient is established by different surveys and in that field, they have initiated reduction in dose following by those DRL’s.

Different imaging volumes and quality of scans required for radiation therapy planning prevents the use of diagnostic DRLs.

In the literatures while comparing therapeutic dose and its scatter dose with CT localization dose it has been considered as insignificant. To maintain high quality CT image and large CT examination area than the radiation treatment area in pre radiotherapy planning CT may expose cancer patient to higher and perhaps unnecessary radiation dose. Also, inferences are in conflict with the probabilistic model. Many literatures have provided evidence that probabilistic effect of radiation affected malignancy is increased at exposures which are similar with radiation-dose due to CT.

DRL helps in development of new protocols for various CT examination and verifies the existing protocol at each center by comparing the radiation dose from present practice.

DRL have been set at approximately the 75th percentile of patient or phantom data from a survey that will be carried across a broad user base using specific dose-measurement protocol. The dosimetric quantities recommended in the guidelines for the establishment of DRLs are volumetric CT Dose Index (CTDIvol) for a single section and Dose Length Product (DLP) for entire examination. Since there are no DRL's found for Radiotherapy Planning CT simulation procedures in India, the present study will be undertaken to Establishing Diagnostic Reference Levels for Head and Neck and pelvic cancer Computed Tomography protocols in radiation therapy.

**Literature Review**

Sean O’ Connor et al., Celine Clerkin et al. conducted study to establish occurrence of variation in CT dose in breast and head and neck radiation therapy in different centers of Ireland for the establishment of national DRLs. Study concluded that there is a need for optimization of radiation dose to help in reducing total radiation dose.

A. Sanderud et al. conducted a study on the difference in Radiation dose between thoracic radiotherapy CT and thoracic diagnostic CT scans. He found that radiation dose given to RT CT is on an average five times higher than the dose given in diagnostic CT. The difference is because of not considering the patient size in RT CT. He concluded that it is important to use CT protocol which is optimized using patient size.

Chang et al. conducted a study to optimize image quality and dose for adult and pediatric patients who are undergoing for computed tomography scans. Optimized protocol arrived by subjective analysis of phantom image. He found optimum parameter for scanning of adult and pediatric and IR approach is strongly recommended for both adult and pediatric CT scanning to reduce radiation dose with optimum image quality.

**Research Gap**

- Lack of studies to establish the DRLs in India for adult CT required for Radiotherapy Planning.
- Optimization of dose for Radiotherapy Planning CT - worldwide.

**Need for the study**

- International organizations (ICRP, IAEA, UNSCEAR, WHO) encourage all countries to establish DRL in order to optimize patient doses.
- There are no established DRL for Radiotherapy Planning CT protocol in India.
- The typical values to be obtained in this facility will add information to the literature which can be used to establish local/national/regional DRL values for Radiotherapy Planning CT.
- Lack of studies to optimize CT dose values for Radiotherapy Planning in patient’s population

**Aim**

- To establish Diagnostic Reference Levels and optimization of radiation dose of head and neck and pelvic imaging in pre Radiation therapy planning computed tomography (RTCT).
Objectives

- To establish Diagnostic reference level for Head & Neck CT and Pelvic Computed Tomography in radiation therapy planning.
- To optimize radiation dose to the cancer patients undergoing Head & Neck and Pelvic Computed Tomography scans

Significance of the Proposed Study

- Establishing the DRLs will identify the radiation doses for CT examination in Head and Neck and pelvic radiotherapy patients
- Helps in optimizing the radiation dose to the adults by maintaining the optimum diagnostic image quality.
- The study will be useful in reduction of radiation-induced effects.

Expected Outcome

- Establishment of diagnostic reference level for optimized radiation dose protocol
- Reduction in radiation dose in optimized dose protocol in comparison with existing dose protocol for CT Head & Neck and pelvis without compromising image quality.

Methodology

Phase I

**Study Procedure:** Cross sectional study will be conducted at Kasturba Hospital using big bore CT scanner. Sample size will be calculated using estimation of mean. Un co-operative patients, minor patients, Patients with dental fillings and metal prosthesis are excluded from the study.

Ethical approval was granted by the Institutional Ethics Committee, Kasturba Medical College and Kasturba Hospital, MAHE, Manipal. The study is approved and registered under CTRI.

Before initiating scan, the following parameters will be collected from CT console for CT examination of head and neck and pelvic such as Make and model of the scanner, Tube potential, Tube current, Scan time, Rotation time, Slice thickness, Slice beam collimation, Pitch, Total slices, Field of view, start couch level and end couch level, Reconstruction algorithm that will be used.

The participant will be explained about the study and written informed consent will be obtained. The age and sex of the participants will be recorded before the scan. The patients will be in supine position on flat couch and immobilization device fixed to particular area of scan with reference markers, head first into the gantry. Patient should set using the external lasers. Scanning will be performed using present Onco scan protocol.

**CT Dose Quantities:** The two dosimetric quantities namely CTDI<sub>vol</sub> and DLP will be recorded from dose info for each patient at the end of scan from CT console.

Effective dose will be calculated using formula:

\[ E = k \times DLP \]

The value of K according to the updated AAPM report 96

Phase II

**Study Procedure:** Optimizing CT radiation dose with respect to CT acquisition parameters would ideally accomplished by conducting the studies based on observer. Initially this can be performed by acquiring CT image of Phantom with different combination of kV and mAs. To find balance between CT image quality and radiation dose, the scans will be acquiring with a Catphan 503 at specified parameters like Rotation time, Slice thickness, Pitch, mAs and kV – all combinations available in CT scanner.

After CT acquisition the phantom images will be reconstructed using different algorithms. Thereconstructed images will be reviewed by experienced Oncologists and Medical Physicists in Treatment planning and contouring station. By using optimal parameters obtained by analysis of phantom data will be used to create protocols based on optimum parameters. The suitable protocol for head and neck imaging and pelvis imaging will be used to acquire patient data. Patient consent will be taken after orally explaining the procedure.

The participants would be in supine position on flat couch and immobilization device fixed to the area of scan with reference markers, head first into the gantry and to be set using lasers. The images will be exported to Treatment planning workstation. The image acquired using optimized protocol will be analyzed by oncologist and medical physicist. They will be asked to do the analysis by visual identification of image in terms of
Spatial resolution of image and structure boundary also by consistency in structure delineation. This analysis will be done blindly without knowing the difference between the image protocols.

Also the obtained CT image will be analyzed for 1. Subjective image quality, 2. Objective image quality and 3. Overall evaluations of image and radiation dose.

**Subjective Image Quality:** The image quality evaluation will be done as per present Guidelines on Computed Tomography Quality Criteria.\(^\text{(19,20)}\). Images will be reviewed independently by two oncologists.

In the subjective image quality evaluation, image noise, and feasibility for therapeutic purpose will be considered. The Radiation Oncologist will assess the visibility of critical organs in the scanned region.

The above parameters would be rated on five-point rating scale were, 1 = cannot identify, 2 = suboptimal, 3 = acceptable, 4 = better than acceptable, 5 = excellently visualized.

**Objective Image Quality:** The objective image quality will be analyzed by taking the ratios of signal-to-noise (SNR) and contrast-to-noise (CNR). For this purpose, regions-of-interest (ROIs) will be manually positioned in each. The ROI area varied from 20–30 mm² to encompass homogeneity of measured tissues. Following equation is used to assess the signal-to-noise (SNR) and contrast-to-noise (CNR) ratios.

**Signal to noise ratio:**

\[
\text{SNR} = \frac{(CT \text{ ROI})}{SD \text{ ROI}} \quad \ldots (18)
\]

**Contrast to Noise Ratio:**

\[
\text{CNR} = \frac{(CT \text{ ROI} - CT \text{ Background})}{SD \text{ Background}} \quad \ldots (18)
\]

**Overall Evaluations of Image and Radiation Dose:** To assess the overall effects and a possible trade-off between image quality and radiation dose, Figure of Merit (FOM), will be used. The equation is shown below

\[
\text{FOM} = \frac{\text{CNR}^2 \times \text{CTDI}_{\text{vol}}}{\text{SD}_{\text{ROI}}} \quad \ldots (18)
\]

The FOMs of all regions of interest in the phantoms will be examined. CT image quality metrics (e.g. CT number accuracy, SNR) were also analyzed as auxiliary assessments.

**Statistical Analysis**

The data will be statistically analyzed utilizing appropriate statistical software.

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<tr>
<th>For first objective</th>
<th>Descriptive analysis</th>
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<td>- Mean and standard deviation of CTDI(_{\text{vol}}), DLP, Effective Dose</td>
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<th>For second objective</th>
<th>Non parametric test for inter individual comparison</th>
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<td>Inter observer agreement for image quality will be performed using Kappa test.</td>
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<td>Determine the correlation between subjective image quality and SNR, CNR, and FOM</td>
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<td>Compare Effective dose of standard dose and optimized dose protocol</td>
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**Risks and benefits**

- There is no potential risk because the participants included in the study are prescribed for CT Head and Neck, Pelvis scan for the Radiotherapy Planning purpose.
- The study is beneficial as the dose information can be used to establish Diagnostic Reference Level for CT of head and neck and pelvic radiotherapy patients and steps can be taken for optimization of CT doses.

**Conflict of Interest:** No potential conflict of interest relevant to this article was reported.

**Source of Funding:** It is Self-funded study.

**REFERENCES**

3. Harrison RM, Wilkinson M, Rawlings DJ, Moore M. Doses to critical organs following radiotherapy and concomitant imaging of the larynx and breast. Br J Radiol 2007; 80:


12. e, S. Johansen a, f Radiation dose differences between thoracic radiotherapy planning CT and thoracic diagnostic CT scans, Radiography 22 (2016) 107e111


A Pilot Study on Comparison of Radiation Dose in Present Onco Protocol and Varied Parameters Protocol for Head and Neck and Pelvic Phantom in Computed Tomography

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ABSTRACT

Aim: The aim of this study is to compare the radiation dose in present Onco protocol and low dose protocol for head and neck and pelvic phantom in radiotherapy planning computed tomography and to establish diagnostic reference level.

Objective: We conducted a following study to compare the radiation dose in standard protocol and the scan with different set of parameters.

Methodology: A experimental phantom study was performed in CATPHAN 503 measuring 20cm to investigate the optimization of radiation dose for CT head and neck and pelvis by using different parameters available in CT control console.

Result: The result showed significant change in radiation dose in terms of CTDIvol, DLP and effective with different combination of kVp and mAs without compromising image quality.

Keywords: CT localization, Head and neck, Pelvis

Introduction

In the present scenario taking CT scans are the standard procedures in the clinical treatment planning process in Radiotherapy Planning for all cancer cases. While taking CT, with tumor tissue normal tissues also will be exposed to radiation. This imaging method is results in radiation doses and carries a cancer risk. In Radiological safety aspect other than therapeutic radiation, exposures are ruled by the principle “as low as reasonably achievable”, with Radiotherapy Planning CT simulation lies in the bracket. Hence, it becomes essential as radiation exposure to the participant follows the principle. (1)

A quality CT image for Radiotherapy planning purpose should be obtained with optimized dose to the patients. The Radiation dose in CT imaging is depends on many technical factors used to perform CT examinations. For example, of the technical factors milli amperage seconds (mAs) which is the combination of tube current and slice scan time, tube peak kilo voltage (kVp), pitch in multi-slice, rotation time, CT slice thickness, and filtration. By changing these factors together can vary the Radiation dose in CT scanning.

The survey data from 1991 to 1996 shows that 34% of the annual collective dose in Medical exposure is only because of CT scan modality. This new biological information on radiation harm and estimated risk ICRP revised its recommendation in publication 60. It introduces new concepts like diagnostic reference levels and
Optimization of Radiation dose with quantities CT dose index which gives radiation dose per slice and dose length product which gives the total scan length and dose. (2)

DRL for adult diagnostic scans are established based on different studies and surveys and already initiated the dose reduction using established DRL’s. The requirement of different scan length and image quality in Radiotherapy necessitates the establishment of separate DRL for Radiation therapy planning CT scans.

In the literatures CT scan dose has been considered as insignificant when compared to therapeutic dose(3, 6). When we consider the linear non threshold model it is not insignificant. CT localization dose comes under non therapeutic dose which is ruled by the radiation safety principle called as low as reasonably achievable. DRL is a level defined to identify condition where the patient dose is unusually high. DRL is used under the objective that it should avoid the unwanted radiation dose which will not add any extra information to the clinical use.

Many literatures have provided evidence that probabilistic effect of radiation affected malignancy is increased at exposures which are similar with radiation-dose due to CT. (3)

New protocols can be developed by using DRL to verify the existing protocol by comparing the radiation dose. (4-9)

DRL have been set at approximately the 75th percentile of data collected form patient or phantom from a survey that will be carried across a broad user base using specific dose-measurement protocol (9, 10). The dosimetric quantities recommended in the guidelines for the establishment of DRLs are volumetric CT Dose Index (CTDIvol) for a single section and Dose Length Product (DLP) for entire examination (11). Since there are no DRLs has been found for Radiotherapy Planning CT simulation procedures in India, the present study will be undertaken to Establishing Diagnostic Reference Levels for Head and Neck and pelvic cancer Computed Tomography protocols in radiation therapy.

**Literature Review**

Sean O’Connor et al., Celine Clerkin et al. Celine Clerkin et al. conducted study to establish diagnostic reference level for CT of the breast and head and neck radiation therapy. Because there are no DRL for RT setting it exists only for diagnostic procedure. Study conducted between different Irish centers. In the present study, CTDIvol, DLP, mAs, tube potential, scan length, slice thickness, scanning margins, use of automated exposure control (AEC) and scanner technology data are collected for 10 patients. Thus, the study concluded that establishment of therapeutic DRLs for head and neck and breast CT scan (1, 2)

A. Sanderud et al. conducted a study on the radiation dose difference between CT of thoracic region for radiotherapy and CT scans of thoracic for diagnostic purpose. He found that radiation dose given to RT CT is on an average five times higher than the dose given in diagnostic CT. The difference is because of not considering the patient size in RT CT. He concluded that it is important to use CT protocol which is optimized using patient size. (10)

S J Foley et al. conducted a study to establish Irish Diagnostic Reference Level for Computed Tomography examinations of adult. Dose data such as CTDIvol and DLP value were collected for 3305 patients that included 30 sites representing 54% of national total. DRLs were proposed for nine different CT examinations such as CT head, sinuses, cervical spine, thorax, HRCT, CT pulmonary angiography, multiphase abdomen, routine abdomen/pelvis and trunk examinations. It was found that proposed DRL values was 42% lower than previously established DRLs and was comparable to other international studies. However, a wide variation in mean dose across sites was noted. Thus the study concluded that there is a need for optimization of radiation dose across Irish CT departments especially in those that exceeds the proposed DRLs (12).

**Methodology**

**Study Procedure:** This study conducted at Kasturba Hospital using big bore CT scanner. Ethical approval was granted by the Institutional Ethics Committee, Kasturba Medical College and Kasturba Hospital, MAHE, Manipal. The study is approved and registered under CTRI.

To develop optimized CT protocol initially the study should be conducted on phantom. Scan will be taken using the present Onco protocol (Ref Table 1 and Table 2). Before initiating scan, the following parameters will be collected from CT console for CT examination of head and neck and pelvic such as Make and model of the scanner, Tube potential, Tube current, Scan time, Rotation time, Slice thickness, Slice beam collimation, Pitch, Total slices, Field of view, start couch level and end couch level, Reconstruction algorithm that will be used.
The phantom has positioned on flat couch by adjusting with the lasers. Scanning will be performed using present Onco scan protocol.

### Table 1: Present Onco head and neck CT Protocol

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>120</td>
</tr>
<tr>
<td>mAs</td>
<td>300</td>
</tr>
<tr>
<td>Slice thickness</td>
<td>3.00 mm</td>
</tr>
<tr>
<td>Increment</td>
<td>3.00 mm</td>
</tr>
<tr>
<td>Pitch</td>
<td>0.813</td>
</tr>
<tr>
<td>Rotation time</td>
<td>1 sec</td>
</tr>
<tr>
<td>Matrix</td>
<td>512 × 512</td>
</tr>
<tr>
<td>Collimation</td>
<td>16 × 1.5</td>
</tr>
<tr>
<td>Resolution</td>
<td>High</td>
</tr>
<tr>
<td>Reconstruction mode</td>
<td>Filtered back projection</td>
</tr>
</tbody>
</table>

### Table 2: Present Onco pelvis CT Protocol

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>kV</td>
<td>120</td>
</tr>
<tr>
<td>mAs</td>
<td>300</td>
</tr>
<tr>
<td>Slice thickness</td>
<td>5.00 mm</td>
</tr>
<tr>
<td>Increment</td>
<td>3.00 mm</td>
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<tr>
<td>Pitch</td>
<td>0.813</td>
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<tr>
<td>Rotation time</td>
<td>1 sec</td>
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<tr>
<td>Matrix</td>
<td>512 × 512</td>
</tr>
<tr>
<td>Collimation</td>
<td>16 × 1.5</td>
</tr>
<tr>
<td>Resolution</td>
<td>High</td>
</tr>
<tr>
<td>Reconstruction mode</td>
<td>Filtered back projection</td>
</tr>
</tbody>
</table>

CT Dose Quantities: The two dosimetric quantities namely CTDI<sub>vol</sub> and DLP will be recorded from dose info for each patient at the end of scan from CT console. Effective dose will be calculated using formula:

\[ E = k \times DLP \]

The value of K according to the updated AAPM report 96

To develop optimized CT protocol, the qualitative and quantitative analysis of the image should be done. We performed this study by acquiring CT image of Phantom with different combination of kV and mAs. To find balance between CT image quality and radiation dose, we acquired images of a Catphan 503 which simulates head & neck and 30X30 plastic phantom which simulates pelvic region.

After CT acquisition the phantom images reconstructed using filtered back projection algorithms. The reconstructed images analyzed by experienced Medical Physicists in Treatment planning and contouring station.

They will be asked to do the analysis by visual identification of image in terms of spatial resolution of image and structure boundary also by consistency in structure delineation. This analysis will be done blindly without knowing the difference between the image protocols.

Also the obtained CT image analyzed for 1. Subjective image quality, 2. Objective image quality and 3. Overall evaluations of image and radiation dose.

**Result and Discussion**

The result showed significant change in radiation dose in terms of CTDI<sub>vol</sub>, DLP and effective with different combination of kVp and mAs (Ref Table 3).

### Table 3: Phantom test outcome

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Region</th>
<th>kV</th>
<th>mAs</th>
<th>CTDI&lt;sub&gt;vol&lt;/sub&gt; (mGy)</th>
<th>DLP (mGy.cm)</th>
<th>Effective dose(mSv)</th>
<th>Percentage variation of Effective dose w.r.t 1.7 mSv (120kV,300mAs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Head and Neck</td>
<td>90</td>
<td>200</td>
<td>5.22</td>
<td>160.5</td>
<td>0.5</td>
<td>↓70.5%</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>300</td>
<td>7.83</td>
<td>213.2</td>
<td>0.66</td>
<td></td>
<td>↑61.17%</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>120</td>
<td>200</td>
<td>11.84</td>
<td>330.6</td>
<td>1.025</td>
<td>↓39.7%</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>300</td>
<td>17.76</td>
<td>533.3</td>
<td>1.7</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>140</td>
<td>200</td>
<td>17.44</td>
<td>506.8</td>
<td>1.57</td>
<td>↑7.64%</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>300</td>
<td>26.16</td>
<td>729.2</td>
<td>2.26</td>
<td></td>
<td>↑33%</td>
</tr>
<tr>
<td>7</td>
<td>Pelvic</td>
<td>90</td>
<td>200</td>
<td>7.33</td>
<td>175.8</td>
<td>2.637</td>
<td>↑65%</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>300</td>
<td>10.55</td>
<td>240</td>
<td>3.6</td>
<td>↓52.5%</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>120</td>
<td>200</td>
<td>14.80</td>
<td>422.2</td>
<td>6.33</td>
<td>↓16.5</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>300</td>
<td>17.76</td>
<td>505.5</td>
<td>7.58</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>140</td>
<td>200</td>
<td>21.8</td>
<td>715</td>
<td>10.725</td>
<td>↑41.5</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>300</td>
<td>26.16</td>
<td>729</td>
<td>11</td>
<td></td>
<td>↑5.1</td>
</tr>
</tbody>
</table>
In our study the experiment was conducted with Low kVp, standard kVp and high kVp onco protocol to determine the effect of kVp on radiation dose and image quality. The outcome result shows that as compare to standard and high kVp protocol there is a drastic reduction in radiation dose in low kVp onco protocol with optimum image quality as compare to the standard and high kVp protocol. For Head & Neck, at 90 kVp 200mAs we found that 70.5% reduction in the radiation dose as compared to 120 kVp, 200mAs. Similarly at 90 kVp 300mAs we found that 61.17% reduction in the radiation dose as compared to 120 kVp, 200mAs. For pelvis, at 90 kVp 200mAs we found that 65% reduction in the radiation dose as compared to 120 kVp, 200mAs. Similarly at 90 kVp 300mAs we found that 52.5% reduction in the radiation dose as compared to 120 kVp, 200mAs

**Conclusion**

The outcome of the study shows that low kVp onco protocol of Head & Neck and Pelvis protocol gives optimum image quality with reduced radiation dose as compared to standard and high kVp onco protocol.

**Conflict of Interest:** No potential conflict of interest relevant to this article was reported.

**Source of Funding:** It is Self-funded study.

**REFERENCES**


4. Harrison RM, Wilkinson M, Rawlings DJ,Moore M. Doses to critical organs following radiotherapy and concomitant imaging of the larynx and breast. Br J Radiol 2007; 80:


12. c, S. Johansen a, f Radiation dose differences between thoracic radiotherapy planning CT and thoracic diagnostic CT scans, Radiography 22 (2016) 107e111


Sensitization of Medical Teachers on Teaching Learning Procedures Based on Guidelines of Medical Council of India-A Study in West Bengal

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ABSTRACT

Medical Education has always been considered for reformations to render a fruitful teaching to the students to meet the constantly changing social need to get an appropriate medico of first contact. Creation of Medical Education Technology Cell at the medical colleges and evaluations from students are the basic steps of it. MCI guidelines also have been changed accordingly with an inclusion of AT-COM (attitude and communication) and a requirement of teachers training through sensitization of the medical teachers with the newly formed idea has come up. Based on this concept a sensitization workshop was conducted at Malda Medical College for the doctors attached to Medical Education Service of West Bengal. Answers of Pre and Post workshop questionnaire given to the doctors were collected, tabulated, analyzed and conclusion has been drawn with an objective to get an idea of further development of policies on it.

Keywords: Medical Education, MCI, AT-COM, guidelines, teachers training.

Introduction

Charaka Samhita lays down that teacher should be one “whose doubts have been all cleared in respect of medical scriptures—possessed of experience—clever in the practice of his profession...”. Medical Teaching concept, thus, may be considered as has been originated long back and regularly has been reformed and structured as per the need of the time. Medical teachers are also the curricular developers and transactors and thus have a pivot role in shaping the future medicos. During training period adequate emphasis is placed on inculcating logical and scientific habits of thought, clarity of expression and independence of judgement; and ability to collect and analyse information and to correlate them. In west Bengal after the establishment of West Bengal University of Health Sciences in 2003, the scenario of medical education has been more systematic through formation of uniform syllabus, teaching methodology and evaluation of medical students., along with regular conduction of teachers training programs. The Medical Council of India has prepared revised regulations on Graduate Medical Education and Curriculum for which faculty development has been seen to play a key role in implementation and sustenance of any curriculum reform. At Malda Medical College of West Bengal, one workshop was conducted for medical teachers to sensitize them on changed guidelines of MCI on teaching learning and attitude communication (AT-COM). Present study is based on pre and post test questionnaire to the medical teachers who attended the workshop. The results have been tabulated, analyzed and conclusion formed in an attempt to avail a fruitful outcome for reformation of policies in future.

Objectives

1. Collection of answers of the Pre and Post Workshop Test Questionnaire
2. Analysis of the answers and formation of probable explanations

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Email: drsarkar75@gmail.com
3. Formation of concepts on gaps of persisting knowledge
4. To draw a conclusion that may help to adopt further policies

**Materials and Method**

An workshop entitled as “Sensitization of Medical Teachers on Teaching Learning and Communication (AT-COM) Competencies for INDIAN MEDICAL GRADUATES based on MCI guideline” was organized at Malda Medical College of state of West Bengal. Total 20 persons of medical fraternity attached to medical education service of the state attended the program as learner. One semi-structured questionnaire form having 10 MCQ pattern questions with few single answer type and few multiple answer type was presented to all of them before and after the completion of the workshop as PRE and POST TEST questionnaire. The questions were formed to cover the primary aspects of the Medical Education concept as per guideline of MCI. The results were tabulated on three parts – i) correct ii) incorrect, iii) not attended for both PRE and POST series. For questions having multiple answers, partial attempts have been considered as incorrect answers. Percentage of each answers in both pre and post workshop papers were analyzed accordingly. Strict confidentiality was maintained to avoid disclosure of identity of doctor.

**Questionnaire:**

1. Write the full form of WWW in relation to internet application….
2. Write the full form of OSCE……………………………..
3. Which are stated to be primarily required for one Indian Medical Graduate
   a. Goals
   b. Feedback
   c. roles
   d. Competencies
4. Different types of assessments are-
   a. Subjective
   b. Formative
   c. Summative
   d. Internal
5. In India at Undergraduate Medical Education a Medical Teacher should-
   a. Work effectively with colleagues
   b. Be able to discuss disease and treatment to patient satisfactorily
   c. Apply newly gained knowledge and skill
   d. Manage ethical and professional conflicts
6. As per MCI, five ROLES of IMG are-
   a. Clinician, learner, listener, leader, communicator
   b. Clinician, physician, listener, leader, care giver
   c. Clinician, care giver, listener, leader, communicator
   d. Clinician, learner, professional, leader, communicator
7. Which are considered as teaching learning methods-
   a. Flip Chart
   b. Problem Based Learning
   c. Small Group Discussion
   d. Students Seminar
8. Domains of learning are-
   a. Cognitive
   b. Psychomotor
   c. Affective
   d. Empathy
9. Self Directed Learning is an effective teaching Procedure for–
   a. Babies
   b. Early Teenage
   c. Late Teenage
   d. Adults
10. AT-COM is advised to be taught during MBBS course-
    a. Beginning of 1st yr
    b. Late session of 2nd yr
    c. As a topic of 3rd year
    d. Throughout the course
Results

Pretest and Posttest Answer Script Outcome:

<table>
<thead>
<tr>
<th>Question No</th>
<th>PRETEST Correct</th>
<th>PRETEST Incorrect</th>
<th>PRETEST Not Attempted</th>
<th>POSTTEST Correct</th>
<th>POSTTEST Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20(100%)</td>
<td>0</td>
<td>0</td>
<td>20(100%)</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>10(50%)</td>
<td>1(5%)</td>
<td>9(45%)</td>
<td>20(100%)</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>3(15%)</td>
<td>16(80%)</td>
<td>1(5%)</td>
<td>16(80%)</td>
<td>4(20%)</td>
</tr>
<tr>
<td>4</td>
<td>2(10%)</td>
<td>15(75%)</td>
<td>3(15%)</td>
<td>17(85%)</td>
<td>3(15%)</td>
</tr>
<tr>
<td>5</td>
<td>8(40%)</td>
<td>9(45%)</td>
<td>3(15%)</td>
<td>11(55%)</td>
<td>9(45%)</td>
</tr>
<tr>
<td>6</td>
<td>6(30%)</td>
<td>11(55%)</td>
<td>3(15%)</td>
<td>9(45%)</td>
<td>11(55%)</td>
</tr>
<tr>
<td>7</td>
<td>2(10%)</td>
<td>16(80%)</td>
<td>2(10%)</td>
<td>15(75%)</td>
<td>5(25%)</td>
</tr>
<tr>
<td>8</td>
<td>6(30%)</td>
<td>12(60%)</td>
<td>2(10%)</td>
<td>18(90%)</td>
<td>2(10%)</td>
</tr>
<tr>
<td>9</td>
<td>16(80%)</td>
<td>2(10%)</td>
<td>2(10%)</td>
<td>19(95%)</td>
<td>1(5%)</td>
</tr>
<tr>
<td>10</td>
<td>14(70%)</td>
<td>1(5%)</td>
<td>5(25%)</td>
<td>20(100%)</td>
<td>0</td>
</tr>
</tbody>
</table>

In post test series, all of the participants attempted all questions.

Results show that question No 1 has been correctly given by all in the pretest, while Qn no 2 though could be given by 50% in the pretest, all gave correct answer in posttest. 80% gave incorrect choice in pretest for Qn 3 but 80% gave correct Ans in post test. For Qn no 4, Correct Ans was 10% in PRE while 85% in POST test. In Qn No 5, results shows in PRE 45% was incorrect, in POST 55% gave correct options like Qn No 6, where PRE incorrect is 55%, but POST correct is 45%. In Qn No 7, while 10% gave correct ans in PRE, it became 75% in POST TEST. Qn 8 shows 60% incorrect in PRETEST, while 90% correct in POST TEST. Correct option was 80% in Qn 9 in PRE, which became 95% in POST TEST. In the last question, where 70% could gave correct option in PRE, it became 100% in POST TEST answer.

Discussion

It is well known that there is a 30% -40% shortage of medical teachers across India.

As inspite of such scenario, medical education is needed to be continued, specific target oriented training for teachers are necessary. Conduction of small workshops on it at the peripheral levels are of definite help to cope up the situation as is found during such types of studies.

The questionnaire was formed without prior mentioning that few questions have multiple answers to find the extent of knowledge on that topic and to give a chance of a sincere thought. The topics of each question was on basic idea of Medical Education appropriate for any beginner. The results show fruitful outcome.

Qn 1 has been given correctly by all of the participants showing expected awareness on internet. It has been seen that e-learning which is a regular practice for any teaching methodology, has been considered as complement to traditional instructor led teaching OSCE, at Qn 2 has been correctly told by half of the participants initially, and all could give correct answer after completion of the workshop discussion. This is a definite outcome as objective structured questions have been instructed to be formed during clinical teaching. Regarding IMG (Indian Medical Graduate) requirement as in Qn 3, it is observed that even after completion of workshop, one fifth(20%) participants could not give correct answer which is a matter of concern, and in the next workshops this topic must get emphasis. Evaluation through assessments are supposed to be most important for any education methodology, as seen in Qn 4,at POST TEST, 85% could give correct answer which was 10% at PRE TEST. Monitoring the day to day learning by Formative Assessment and At the end through Summative, is the existing system while it has been pointed that this system neglects the psychomotor, affective and communication skill. For both Qn 5 and Qn 6 in pretest, incorrect answers were given by more or less 50% and correct post test again 50%. Both the questions were primarily on Indian Medical Graduate’s clinical work, and overall 50% correct concept by teachers may be considered satisfactory. Qn 7, on teaching learning methods show that only 10% participant had clear idea on it which is of definite concern. Even after a discussion, 25% could not give correct answer. Competency Based Medical Education (CBME) has attracted renewed interest in recent years among the medical educators and different teaching methodologies are very much required to be
known to any medical teacher. Different domains were correctly said by 90% in the POSTTEST question 8. Qn 9 was satisfactorily answered even in PRETEST as 80%. Qn 10 could be answered by all (100%) after completion of the workshop. Thus after overall consideration, it can be said that satisfactory improved correct answers were provided by the participants after the completion of the workshop.

**Conclusion**

Medical Education Technology is changing day to day. Thus the age-old lecture based one-way education method has been changed to Competency Based learning to meet the need of hugely populated Country like India. Though besides other tools, e-learning, problem based learning, self directed learnings have been evaluated or discussed through different angles, the addition of AT-COM by MCI has been a correct step. Medical research is another aspect which has been neglected. Research activity is necessary to ensure progress in the quality of health care and CBME can get success through honest approach to research skill. A regular evaluation of students and vis a vis of a medical teacher is supposed to be the rational way of improvement of medical education and thus the health care system of our country.

**Conflict of Interest:** None

**Source of Funding:** Self

**Ethical Clearance:** Clear

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9. Ananthakrishnan N. Medical Education in India: Is it still possible to reverse the downhill trend?. The National Medical Journal Of India. 2010;23(3):156-160
Impact of Celebrity Endorsement on Surrogate Advertisement among Youth in Kerala

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¹M.Com Student, ²M.Com Student, ³Assistant Professor, Department of Commerce and Management, Amrita School of Arts and Sciences, Kochi

ABSTRACT

The purpose of this study is to examine the impact of celebrity endorsement on surrogate advertisement among youth in Kerala. Advertisements are considered to be a very effective medium to reach the mass audience. It is the best way of communicating the product or services of a company to a large group of target audience.

Celebrity endorsement is a marketing technique in which celebrity allow an entity such as brand, a product and others to use their name in promoting or supporting the entity (Bergkvist & Zhou, 2016). This celebrity endorsement is proven to effect purchase intention (Gupta, Kishore & Verma, 2015; McCormick, 2016; Pornpitakpan, 2004; Wang et.al. 2013).

Surrogate advertising is a kind of advertisement of a brand extension in such a way that brings clear recall of the core product in the minds of the consumer. The aim of surrogate advertising is effective communication between manufactures and consumers with the object to sell a product, service or idea which they could not do otherwise (Deepa Nathwani, 2016).

Based on the analysis of the primary data, it was revealed that celebrity endorsement has a positive impact on surrogate advertisement among youth. Among the demographic variables, age and educational qualification played a pivotal role in the recall of original products.

Keywords: Advertisement, Celebrity endorsement, Surrogate advertisement

Introduction

Advertising is now an inevitable constituent in one’s life. In the present era, advertisement contributes immensely in the modernization of the economy of various countries. The sole aim of advertisement is to present and communicate a new product in the market focusing on targeted consumers commercially. So, a good advertisement helps in building a good brand image and brand identity in the mind of consumers.

There are different forms of advertisements that are presently available. Celebrity endorsement and surrogate advertisement are among them. Celebrity endorsement is a type of advertising in which a famous person is involved in promoting the product or brand. In this way, the celebrity endorsement can have a great influence in the minds of people [Dominguez, R; Herrero, A; Salmones, M (2013)].

A surrogate advertisement is a kind of advertisement in which a different product is promoted using an already established brand. Such advertisements help in contribute to brand recall. ‘Surrogate advertising’ literally mean duplicating the brand image of one product extensively to promote another product of the same brand. Surrogate advertising is done when the original product is not allowed to advertise itself on various Medias.

Tobacco and liquor are the main reference point in the context of surrogate advertisement. Brands are Gold Flake, Wills Lifestyle, Mc Dowell’s, Imperial Blue, etc.

It is a kind of advertisement which actively supports or encourages the banned products like alcohol, cigarettes, pan masala, etc. in concealing the identity of another product. This advertising uses club soda, mineral water, music CD, playing cards, etc. to instill the brand to the customers. The banned product is not forecasted to customers directly, but it conceals another product
with same name. In such a way, when people saw these types of advertisements, people start connecting it with the main product.

Some of the surrogate advertising brands in India are Bacardi Blast music CD’s, Bagpiper club soda to Officer’s Choice playing cards etc. [Lamb, Charles W; Hair, Joe F; Mc Daniel, Carl].

The surrogate advertisers are Wills, Manikchand, Bacardi, Kingfisher, Aristocrat, Smirnoff, Seagram, etc.

Some of the examples of celebrity endorsement on surrogate advertisement are Shah Rukh Khan in Seagram Royal Stag music CD, Priyanka Chopra in Rajnigandha cardamom, Saif Ali Khan in Pan Bahar, etc.

The study is totally based on a targeted group. Mainly, the youth (i.e., between the age group of 18-24) are taken for this study.

**Literature Review**

The researcher has made an attempt to bring out all the relevant literatures in the area of celebrity endorsement and surrogate advertisement. The following table depicts the literatures reviewed:

Abhishek & Aravind Sahey (2016)[1] studied about the role of culture in celebrity endorsement. Multiple endorsements by celebrities in India are more as compared to other low PDI countries. Impact of regional celebrities has a strong acceptance in a geographical area. In case of negative news about a celebrity, the companies will continue to associate with that celebrity.

Avadhesh Vyas & Gaurav Bissa (2017)[2] studied about the surrogate advertisement on television. Celebrities will bring a negative impact on youth. They will attract on these advertisement with celebrity endorsement. Surrogate advertisements on television accomplished in violating the law.

Deepa Nathwani (2016)[3] in her study on surrogate advertisement founds that Surrogate advertising helped to promote brand name or brand product. Celebrity endorsement is the major factor to the increasing use of alcohol. The consumers between the age group of 16 & 40 are the major users of the original products of surrogate advertisements. The high addiction of youth to these alcohols will lead to a loss to the nation.

Hampesh K S (2017)[4] in his study on using celebrities in advertisement founds that majority of the respondents like commercial advertisements. Celebrity endorsement is mainly used for gaining popularity. A brand ambassador will be associated with the product for long time. Most of the respondents are not much aware of covert advertising. People buy products when their loved celebrity affirms it. Many respondents are also conscious about quality, durability and performance.

Nancy Motwani (2016)[5] in her study on perception regarding morality of surrogate advertisements of liquor states that the opinions of the viewers about the surrogate advertisements are unethical and should ban the alcoholic products. Surrogate advertisements are a hulking and successful marketing strategy for banned products.

Punit Kumar, Amit Verma, Ranit Halder & Punjala Varun Datta (2017)[6] studied about the surrogate advertising in alcohol industry. The users of the product are not much aware about the advertisement that the company wants to convey. The effective mode of advertisement is through online. Most of the people remember alcohol advertisement because these advertisements were funny. Most consumers find these advertisement misleading.

Shivesh Rajpal & Amrita Nayak (2015)[7] studied on surrogate advertisement on consumer perception. Majority respondents are aware of surrogate advertisements and these changes the people’s approach towards the product. Advertisement is the best medium for the people to buy the product.

Soumya Dutta & Saswati Gangopadhyay (2015) [8] studied on the surrogate advertising on satellite television. The main products that have far reaching consequences due to surrogate advertisements are tobacco products, pan masala and liquor. Surrogate advertisement succeeded in violating the law and also television channels are responsible for accepting such advertisements.

**Research Gap:** Though there are plenty of studies were conducted separately about celebrity endorsement and surrogate advertisement in International context, but no combined research works were undertaken so far and India is not an exemption to that. Hence, this study aims to fill the void in the literature, and is quite relevant and timely from the point of view of academic and policy makers.
Research Objectives

To achieve the purpose of the present study, the researcher formulated the following objectives:

1. To understand the level of customer awareness towards surrogate advertisement among youth.

2. To examine the relationship between celebrity endorsement and surrogate advertisement.

3. To assess the effect of celebrity endorsement on surrogate advertisement in the purchase intention among youth.

Research Hypotheses: The literature review indicates that the curve has increased in the number of studies of surrogate advertisement and celebrity endorsement, but that more is still needed. In the light of above conditions, the current study emphasize on the following 6 hypotheses developed from earlier studies.

H1a: Celebrity endorsement will have a positive impact on surrogate advertisement among youth.

H1b: There is a positive association between age and the recall of original products while seeing the surrogate advertisements.

H1c: There is a positive association between gender and the recall of original products while seeing the surrogate advertisements.

H1d: There is a positive association between educational qualification and the recall of original products while seeing the surrogate advertisements.

H1e: There is a positive association between occupation and the recall of original products while seeing the surrogate advertisements.

H1f: There is a positive association between monthly income and the recall of original products while seeing the surrogate advertisements.

Research Methodology

Research Design: The study includes both exploratory and conclusive research designs. The exploratory research comprises the steps such as literature review, finalization of objectives, identification of variables, the formulation of hypothesis, etc.

During the second phase of research, the conclusive research design was used, and this stage includes both descriptive research design and the causal research design. The descriptive research design was used to explain the characteristics of the population, and the causal research design was carried out to find the causal relationship among the variables.

Sampling Design: The population of the study comprises the youth who are viewing surrogate advertisements. The snowball sampling technique was used in the study for the collection of first hand information. In total, 100 samples were used for data analysis.

Tools for Data Collection and Analysis: The current study is primarily based upon first-hand information collected through a well-defined structured questionnaire. The questionnaire consists of 5 general questions and remaining relating to variables to be studied. The criteria for the selection of variables are purely based on previous research work. Respondents were asked to indicate their perception about each question, using a 5-point Likert scale, with responses ranging from “strongly disagree” to “strongly agree”. The study also uses secondary data which has been collected from various sources such as journals, websites, etc.

The gathered data has been tabulated and analyzed through statistical software SPSS 21.0. The statistical tools used were frequency-descriptive analysis, Pearson Chi-square test, Kolmogorov-Smirnov test, Sharpio-Wilk test, correlation analysis and simple regression analysis.

Testing Validity & Reliability: The face validity of the questionnaire was evaluated by detailed checking of the wording of the items in the questionnaire and their connection to the appropriate frame of reference used in the study. The criterion validity was ensured by using a common scale throughout the questionnaire.

The Cronbach alpha (R) test of reliability is considered as one of the most common method for estimating reliability of the questionnaire. The current study also uses the Cronbach alpha test of reliability in order to get a strong internal consistency among the variables. The alpha value found to be 0.70 or above, which ensures the reliability of the questionnaire.
Data Analysis and Discussion

Table 1: Profile of the study (N = 100)

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-20</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>21-24</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Female</td>
<td>53</td>
<td>53</td>
</tr>
<tr>
<td><strong>Educational Qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher Secondary</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Graduate</td>
<td>54</td>
<td>54</td>
</tr>
<tr>
<td>Post Graduate</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Professional</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Private Sector</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Public Sector</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Business</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Monthly Income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below Rs.10000</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Rs.10000-Rs.20000</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Rs.20000-Rs.30000</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Rs.30000-Rs.40000</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Rs.40000-Rs.50000</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Above Rs.50000</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Primary data

The sample of the present study consisted of 100 customers who are viewing surrogate advertisements. Out of 100 respondents, 47% are male and 53% are female. With regard to age, about 15% of the viewers are between the age group of 18-20 years and 85% are between 21-24 years of age category. With regard to educational background, about 8% of the respondents have higher secondary education, 54% are graduates, 29% are post graduates and 9% are professionally qualified. With respect to occupation, nearly 80% of the respondents are students, 15% are working in private sector, and very few are working in public sector and business persons with 2% and 3% respectively. Considering the monthly income of viewers, majority (72%) of the respondents have monthly income below Rs.10000, 9% ranging from Rs.10000-Rs.20000, 7% ranging from Rs.20000-Rs.30000, 4% ranging from Rs.30000-Rs.40000, 3% ranging from Rs.40000-Rs.50000 and nearly 5% have an income above Rs.50000.

Chi-square Analysis: In order to check whether there is any significant difference exists among different groups of customers based on their demographic variables, Chi-square test have been done and the output have been included in below table.

The Demographic Variables and Recall of Original Products While Watching Surrogate Advertisements:
The demographic variables considered under this analysis are age, gender, educational qualification, occupation and monthly income of the respondents. The result from the hypotheses testing is presented in below table. The hypotheses are tested at the significant level 0.05.

Table 2: Testing of hypotheses

<table>
<thead>
<tr>
<th>Variables identified</th>
<th>Hypotheses of the study</th>
<th>P-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1b Age</td>
<td>There is a positive association between age and the recall of original products while seeing the surrogate advertisements.</td>
<td>0.012</td>
<td>Accepted</td>
</tr>
<tr>
<td>H1c Gender</td>
<td>There is a positive association between gender and the recall of original products while seeing the surrogate advertisements.</td>
<td>0.748</td>
<td>Rejected</td>
</tr>
<tr>
<td>H1d Educational qualification</td>
<td>There is a positive association between educational qualification and the recall of original products while seeing the surrogate advertisements.</td>
<td>0.024</td>
<td>Accepted</td>
</tr>
<tr>
<td>H1e Occupation</td>
<td>There is a positive association between occupation and the recall of original products while seeing the surrogate advertisements.</td>
<td>0.625</td>
<td>Rejected</td>
</tr>
<tr>
<td>H1f Monthly income</td>
<td>There is a positive association between monthly income and the recall of original products while seeing the surrogate advertisements.</td>
<td>0.165</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

Source: Primary data
It is clear from the above table that all the hypotheses mentioned are rejected, except age and educational qualification, which means that there is a significant association between these demographic variables and recall of original products while watching surrogate advertisements. On the other hand, there is no such significant association exist between the demographic variables such as gender, occupation and monthly income with the recall of original products while watching surrogate advertisements.

Correlation Analysis:

Table 3: Correlations

<table>
<thead>
<tr>
<th></th>
<th>Cel TOTAL</th>
<th>Sur TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cel TOTAL</td>
<td>Pearson Correlation</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Sur TOTAL</td>
<td>Pearson Correlation</td>
<td>.500**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary data
**. Correlation is significant at the 0.01 level (2-tailed).

It is clear from the above table 4 that Pearson Correlation (0.500**) is significant at 99.99% confidence interval. It indicates that the celebrity endorsement has a large (Cohen, 1988) positive correlation with surrogate advertisement.

Regression Analysis: Simple linear regression analysis was performed to examine the extent to which the independent variable (surrogate advertisement) influences dependent variable (celebrity endorsement). The result of regression analysis indicate that celebrity endorsement (Beta=0.500, P=0.00) significantly affect surrogate advertisement.

Major Findings of the Study: The majority of the respondents were female, aged between 21-24 and graduates. This indicates that most of the respondents are well educated youth. In this study, students were the major viewers of surrogate advertisements and it might be the reason that the students spent most of their time with television and other Medias.

Most of the respondents are aware of surrogate advertisement, but they prefer to buy it occasionally. The viewers are able to recall the original product mostly through logos and celebrities. Kingfisher is the most preferred brand by the respondents and they are of the opinion that it is good for the core brand. Celebrity endorsement is entertaining, but it is not inducing most of the viewers to buy the product. In this study, it is found that Government has not been successful in controlling the consumption of tobacco and liquor by imposing a ban on these advertisements.

The demographic variables such as age and educational qualification have a significant association with the recall of original products while seeing surrogate advertisements. It is also seen that celebrity endorsement has a positive relationship and impact on surrogate advertisement among youth.

Conclusion and Managerial Implications

Celebrity endorsement and surrogate advertisement are the popular methods of advertising. In today’s world, celebrity endorsing on surrogate advertisements are a favorable trend. The celebrities in these advertisement helps to attract the attention of a spectator. The main focus of surrogate advertisement is to bring up the original product through the advertisement of dummy products.

This study has attempted to describe the impact of celebrity endorsement on surrogate advertisement among youth. The celebrity endorsed surrogate advertisements are more able to recall than non-celebrity endorsed advertisements. It is clear that celebrities on surrogate advertisements are misguiding, but finally the decision to consume such product lies in the hands of the consumers. Customers are not against with the surrogate advertisements, but it is indirectly promoting the core brand. It is finally concluded that there is a positive relationship between celebrity endorsement and surrogate advertisement.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: No other companies or organizations are pointed out in these research paper.

REFERENCES

of Indian Culture and Business Management, (2016); 13(3):394.


Introduction: Persistent anemia is one of the most common complications seen in individuals with chronic kidney disease (CKD). The factors contributing to anemia in CKD include loss of blood, reduced lifespan of red cell, vitamin deficiencies, erythropoietin deficiency, iron deficiency, and inflammation. Erythropoietin deficiency appears to be the major cause of anemia among the CKD. It is well established that hemoglobin level tends to decrease in CKD individuals. In renal anemia, hemoglobin level is usually managed with iron therapy and or erythropoietin treatment or blood transfusion. NKF – KDOQI clinical practice recommends hemoglobin level to range from 11g/dL-12g/dL among CKD undergoing hemodialysis (CKD 5HD). Hence it is essential to maintain recommended hemoglobin level among the individuals in order to avoid the mortality rate. In India there is dearth on the database of hemoglobin trend investigated longitudinally, and hence the present study was focused in this direction.

Aim: To investigate the hemoglobin trend in CKD 5HD in a tertiary care hospital.

Objectives: a) To profile the hemoglobin trend among the individuals on erythropoietin alone, combination of erythropoietin and iron therapy, and individuals not undergoing any treatment. (b) To compare hemoglobin trend among the individuals on erythropoietin alone, combination of erythropoietin and iron therapy, and individuals not undergoing any treatment.

Method: Retrospective observational study. A total of N=90 participants were enrolled in the study. The participants were classified into 3 Groups. Group 1- Erythropoietin (n=30), Group 2 - erythropoietin and iron therapy (n=30) and Group 3 – No treatment (n=30). Data were retrieved from medical records who were on regular hemodialysis for more than six months. The hemoglobin level was observed for six months and documented.

Results: In the present study, it was observed that hemoglobin tend to increase among the Group 1 and Group 2 participants, unlike the Group 3 participants, who received no treatment. Among the groups, it was observed the mean hemoglobin level of Group 1- 9.1g/dL was more compared to Group 2 and Group 3 - 8.7g/dL.

Conclusion: It was observed that individuals who were on treatment had a rising trend in hemoglobin unlike individuals with no treatment. However, it could also be observed that the mean hemoglobin was maintained appropriately among individuals with no treatment, which could be probably due to the lifestyle and other individual related factors.

Keywords: Chronic kidney disease, Hemoglobin level, Hemodialysis, Erythropoietin treatment, iron therapy.
lifespan of red cells, vitamin deficiencies, erythropoietin deficiency, iron deficiency, and inflammation\(^{(3)}\). It is well established that the hemoglobin level tends to decrease in CKD individuals \(^{(2, 3)}\). It begins in the early stages of CKD and worsens with the progression, especially predominant during stage 5\(^{(4)}\). Renal anemia is characterized by a relative deficit of erythropoietin, normochromic and normocytic blood cells, and hypoplasia of erythroid cells \(^{(1, 5)}\). It is considered one of the most clinically significant complications of CKD which can have a severe impact on individuals’ quality of life \(^{(2, 6)}\). Hence frequent monitoring of hemoglobin among these individuals is recommended. According to KDIGO guidelines, routine hemoglobin evaluation at least once in a month is recommended to adults who are on maintenance hemodialysis (CKD 5HD) with anemia who are not receiving any treatment \(^{(7)}\). The recommended hemoglobin level ranges from 11g/dL-12g/dL \(^{(7)}\). Hence it is essential to maintain the recommended hemoglobin level among the individuals in order to avoid further complications and the mortality rate.

In renal anemia, hemoglobin level is usually managed with iron therapy and or erythropoietin treatment and blood transfusion as a last option of management. Earlier CKD 5HD individuals frequently required blood transfusions due to non-availability of recombinant human erythropoietin. In addition, individuals undergoing blood transfusion were exposed to the risks of viral hepatitis and sensitization which reduced the chances of successful kidney transplantation \(^{(8)}\). If patients are with iron deficiency, only erythropoietin injections are of no use to maintain the hemoglobin level. According to KDIGO recommendation, erythropoietin injection should be initiated when the hemoglobin level is between 9g/dL to 10g/dL \(^{(7)}\).

**Primary Objective:** To profile the hemoglobin trend among the individuals on erythropoietin alone, a combination of erythropoietin and iron therapy, and individuals not undergoing any treatment

**Secondary Objective:** To compare hemoglobin trend among the individuals on erythropoietin alone, a combination of erythropoietin and iron therapy, and individuals not undergoing any treatment

**Method**

The present study was a retrospective observational study conducted in a dialysis unit of tertiary care hospital. The study protocol was approved by Institutional ethical committee (IEC Ref no: 66/2013).

**Participants:** A Total 90 participants in the age range of 22-75 years were enrolled in the study. The participants were classified into three groups based on their renal anemia maintenance therapy. The first group included the individuals on Erythropoietin injections (Group 1), the second group with individuals on erythropoietin injection and intravenous iron therapy (Group 2) and the third group with individuals who received no treatment (Group 3).

**Inclusion Criteria:** The CKD individuals on maintenance hemodialysis for the duration of six months and were on erythropoietin injection, on a combination of erythropoietin injection and intravenous (IV) iron therapy and individuals who were not on any treatment.

The exclusion criteria were, chronic kidney disease individuals not regular to hemodialysis, age below eighteen and acute kidney injury. Individuals who are on blood transfusion were also excluded from the study.

**Procedure:** This study was an observational study conducted in a Hemodialysis Unit of tertiary care hospital. Data were collected retrospectively for six months. The required data were collected from hospital records (outpatient files, hemodialysis record, and hospital lab result server) who were undergoing hemodialysis in the same unit on regular basis.

The data related to demographic details, renal anemia management therapy, hemodialysis details, hemoglobin levels, vital signs (blood pressure and pulse), pre-dialysis weight, type of vascular access used, and number of years undergoing hemodialysis and serology
reports were documented. After the informed consent, a pre-hemodialysis blood sample was collected towards estimating the hemoglobin level. The hemodialysis was performed using arteriovenous fistula (AVF). AVF was cannulated by the aseptic technique by hemodialysis technologist or hemodialysis nurse. Dry AVF needle (without flushing the needle with normal saline) was introduced to the AVF vein and blood was collected into the appropriately labeled specimen container tubes, further which are sent to laboratories for evaluation. After sample collection, the needles were connected to the extracorporeal circuit of hemodialysis.

Data Analysis

The hemoglobin was evaluated once in a month for a duration of 6 months. The mean hemoglobin values were obtained and were documented and compared across the three groups. The Independent t-test was used as a test of significance to compare across the groups. One way ANOVA was performed to compare between the groups with a significance value of p<0.05.

Result

In the present study, among a total of 90 participants, 75 (83.3%) were males and 15 (16.7%) were females in the age range of 22 to 75 years with the mean age of 51.7 ± 12.3 years, predominantly being the middle-aged adults in the age range of 40 to 59 years. All the participants were hypertensive and 30 of them exhibited Diabetes mellitus. Among them, 7 of them were HCV positive. However, no participants exhibited HIV or HBsAg. The hemodialysis was performed using AVF among all the participants.

<table>
<thead>
<tr>
<th>Groups (N = 90)</th>
<th>Hemoglobin (g/dL) Mean ± SD</th>
<th>Hemoglobin level Range (g/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;9.0 g/dL</td>
<td>9 – 11 g/dL</td>
</tr>
<tr>
<td>Group 1 (n = 30)</td>
<td>9.1 ± 1.1</td>
<td>15 (50%)</td>
</tr>
<tr>
<td>Group 2 (n = 30)</td>
<td>8.7 ± 1.2</td>
<td>19 (63.3%)</td>
</tr>
<tr>
<td>Group 3 (n = 30)</td>
<td>8.7 ± 1.6</td>
<td>20 (66.6%)</td>
</tr>
</tbody>
</table>

Note: Group 1: Individuals on Erythropoietin injections; Group 2: Individuals on erythropoietin injection and intravenous iron therapy; Group 3: Individuals who received no treatment

The mean hemoglobin level was observed to be better among the participants of Group 1 as compared to participants of Group 2 and Group 3. One way ANOVA revealed no significant statistical difference (p=0.302) between the groups.

In the present study, the variability in hemoglobin was also observed among the participants. It was also observed, that the majority of the participants ranged below 9.0 g/dL were more prominent among Group 3 participants. In addition, the hemoglobin trend was observed to be deteriorating among the participants who received no treatment (Group 3) as compared to the other two groups. One way ANOVA revealed a significant difference between the groups with p<0.005. Post hoc analysis was done using Tuckey test. It was observed there was a significant difference between the participants of Group 1 and 2 and between the participants of Group 2 and 3. However there was no difference observed between Group 1 and Group 3 participants.

Discussion

The present study focused on exploring the hemoglobin trend across the different modes of management among the CKD individuals who are on maintenance hemodialysis. It was observed that the participants were middle aged adults predominantly which could be due to their vulnerability which is also in accordance with (9) who reported of CKD being prominent among the 50 to 59 years aged individuals. In terms of gender, it was found males being more prevalent as compared to females. Literature has also evidenced similar findings (10, 11). Although the prevalence of CKD is higher among the females, the progression is slower as compared to males. It is known that the symptoms usually aggravates during the end stage kidney disease, thereby requiring renal replacement therapy. The present study findings could also be due to the interest of the authors only focusing the participants during the end stage kidney disease, thereby comprising of majorly the male participants. (10) had observed similar findings and quoted that this could also be due to the females possessing
hormonal protection thereby postponing the progression rate. It could also be due to risk factors that include the occupational hazards, smoking, and negligence of their health which is common in Indian scenario.

In the present study, the modes of management of anemia among the participants included erythropoietin, combination of erythropoietin and intravenous iron therapy and blood transfusion. The anemia is often reported to be commonly seen during the end stage renal disease that can be managed successfully by erythropoiesis-stimulating agents (ESA) administration which is in consonance with the finding of the present study, wherein the mean hemoglobin level was observed to be better among the participants of Group 1 receiving erythropoietin treatment as compared to Group 2 and Group 3 participants.

It is reported that recombinant erythropoietin tends to improve the overall quality of life of CKD individuals by improving their hemoglobin level. The Dialysis Outcomes and Practice Patterns Study (DOPPS), a prospective observational study based on the data collected from 11,041 hemodialysis participants from 12 countries, the hemoglobin level was less than 11.0 g/dL among 23% to 77% of the participants.

The findings suggested that combination of intravenous iron administration with erythropoietin injection is ideal in order to maintain the hemoglobin level.

Conclusion

The findings of the present study reflected the best-suited treatment mode to an extent among the individuals with anemia secondary to CKD. It also revealed the necessity of monitoring their hemoglobin level and other parameters influencing hemoglobin level that includes iron status, parathyroid hormone level, serum erythropoietin levels, the presence of infection, inflammatory states, blood loss, nutrition, and comorbidities on a regular basis, especially in settings where individuals are reluctant to undergo due to the financial constraints in order to reduce the morbidity and mortality rate and thereby improve overall outcomes.

Acknowledgement

We would like to express our sincere gratitude to Dr. Manohar Bairy G. Consultant Nephrologist, Tan Tock Seng Hospital, Singapore for his valuable suggestions and guidance to complete this study.

Conflict of Interest: None declared.

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REFERENCES


Study of Programme Related Influencing Risk Factors on Multidrug Resistance Tuberculosis: A Case Control Study from Western Maharashtra

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¹Tutor, ²Professor, ³Statistician cum Associate Professor, ⁴Professor & HOD, Department of Community Medicine, Krishna Institute of Medical Sciences, Karad, Maharashtra, India

ABSTRACT

Background: Multidrug Resistance Tuberculosis (MDR-TB) an emerging and a growing threat to tuberculosis control program all over the world. This problem is of special concern because second-line drugs required for its treatment are often unavailable, are far more expensive than the first-line drugs, with only 65-75% efficacy, and have side effects that may require hospitalization. The reasons quoted for the same was inconsistent and or interrupted drug intake or supply.

Objectives: To study programme related variables present in Multidrug Resistance Tuberculosis cases.

Materials and Method: This case-control study was carried out for the assessment of programme related influencing factors for Multidrug Resistance Tuberculosis among TB patients enrolled for DOTS under RNTCP during the period of 2016 to 2018 at various sub-district levels.

Results: Majority of MDR cases (96.2%) were visited by senior tuberculosis supervisor, and 98.1% by DOTS providers. Among treatment profile 98.1% MDR patient were on categories II in which relapse (57.8%), treatment failure (33.3%) and default were 8.8%. High proportion of sputum samples were sent to Designated Microscopy centre (51.9%) at grass root level followed by Districts Tuberculosis center (18.3%) and at Tuberculosis unit (16.3%). Most patients (78.8% cases) lived at a distance less than 2.5 kilometer from DOTS provider.

Conclusion: If the guideline given by the Revised National Tuberculosis Control programme is implemented smoothly at the level of District then there would not be any program based reason to develop resistance to primary anti tubercular drugs.

Keywords: Multidrug Resistant Tuberculosis, RNTCP, Influencing factors, Programme.

Introduction

Multidrug resistance tuberculosis is an emerging as growing threat to tuberculosis control program all over the world. In 2013, in India 62,000 cases of multidrug resistant had been reported. One third of the world’s population is infected with MDR tuberculosis, it has been already estimated. Although, anti TB drugs have been available for the past 50 years, tuberculosis remains a major cause of morbidity and mortality all over the world.¹ Weak health systems, the HIV pandemic and emergence of MDR tuberculosis strains that are resistant to conventional drugs used in TB treatment remained major threats to TB control.² Poverty, such as poor living conditions and overcrowding are some factors contributing to the tuberculosis epidemic.³ ⁴

Inappropriate or incorrect use of antimicrobial drugs, Using ineffective drug formulations (eg. Single drug treatment), Treatment interruption (not completing the prescribed complete treatment), poor
supervision. Further mismanagement of these TB cases from healthcare givers and ongoing person to person transmission become the reason for emergence and spread of MDR TB.5

Thus the present study was aimed to explore an association of MDR-TB with various programme related influencing risk factors among the registered tuberculosis cases under RNTCP in the district Satara.

Material and Method

Study Design: A case-control study was carried out for the assessment of Programme related influencing factors for Multidrug Resistance among Tuberculosis patients enrolled for DOTS under Revised National Tuberculosis Control programme during the period of 2016 to 2018 at various sub district levels.

Study Population: The TB patients who were on DOTS and were suspected for Multidrug Resistant tuberculosis were subjected to CBNAAT. Total 2475 tuberculosis cases were suspected to have multi drug resistant tuberculosis were subjected for CBNAAT, out of these cases, 120 tuberculosis patients were confirmed to have multi drug resistance, 07 were XDR TB and 2348 were confirmed Drug sensitivity towards first line treatment and were continued with DOTS. After applying exclusion criteria total 104 MDR TB patients were enrolled in the study as cases and on Age, Sex and Tuberculosis Unit match, controls were selected from those TB cases who were confirmed sensitivity to primary drugs (2348).

Matching: For each MDR-TB case, one control was selected who was on DOTS and sensitive to both Isoniazide and rifampicine by CBNAAT. The control was selected from the same Tuberculosis Unit and was matched with the case with respect to gender and age difference of 5years.

Exclusion Criteria: All severe cases of MDR Tuberculosis admitted at DTC and all XDR TB cases were excluded from the study. Patients below 5 years and above 70 years of age were excluded from the study. Unwilling subjects from cases and controls were excluded from the study.

Sample Size: After applying exclusion criteria total 104 cases were enrolled in the study as study subjects and for each case one control was matched. Therefore total 104 cases and 104 controls were studies.

Study Instrument: Structured Questionnaire was used to record patients information which was validated by District Tuberculosis Officer and approved by Operational Research Committee under RNTCP.

Data Collection: Data was collected from records available at sub-district hospital i.e. tuberculosis unit under Satara district. Total 10 tuberculosis unit were considered and from each TU 5 to 8 cases and similar number of controls with age and sex matched were considered for data collection. The record based information was confirmed by meeting respective cases and controls as well as by interviewing STS and medical officer of tuberculosis unit. The information was obtained pertaining to visits paid by the contractual staff and by DOTS provider for address confirmation, retrieval action. Information on place for sputum investigation, patients previous treatment profile, follow up examination and investigation, consistency in medication, distance between DOTS provider and patients house were obtained.

Statistical Analysis

Data was analyzed by using a statistical software SPSS version 20. Chi-square test, and Fischer’s exact test was applied to find the association between various factors with drugs sensitive and resistant TB cases. Multi-variate analysis was carried out. The strength and magnitude of the association of MDR- TB with Programme related influencing factors were expressed in term of Odds-ratio. P value < 0.05 was considered as level of significance.

Observation and Results

In the Present study total 208 Tuberculosis patients were studied. In this case-control study 104 cases and similar number i.e. 104 controls were studies. Among all TB cases, 63.5% were male and 36.5% were female.

For addressed confirmation of tuberculosis patients was ensured by the STLS and STS with the help of TB health visitor before putting them on treatment by paying home visit. It was observed that 96.2% cases and 95.2% controls were visited by either senior treatment supervisor or senior tuberculosis laboratory supervisor for address confirmation and rest of them were not visited by senior treatment supervisor or Senior tuberculosis laboratory supervisor, However had visited by Tuberculosis Health
Visitor. The coverage by TBHV in the current study observed only at district headquarters and one of sub district headquarter where medical college is located. It was seen that among cases 98.1% and 100% controls were visited by DOTS provider at least one or more than one times during the course of treatment. (Table-1)

It was reported that high proportion of sputum samples were sent to Designated Microscopy centre at grass root level followed by at Tuberculosis unit and Districts Tuberculosis center. Among MDR cases nearly half of the samples (51.9%) were investigated at Designated Microscopy centre level followed by Districts Tuberculosis center and Tuberculosis unit. In comparison with drug sensitive tuberculosis cases sputum samples of multidrug resistant tuberculosis cases were referred to Intermediate referral laboratory Pune in high proportion (13.5%). This indicates that the multidrug resistant tuberculosis cases have diagnosed their status of tuberculosis at higher level. (Table-2)

It was noted that almost all cases of tuberculosis which were subjected for(multidrug resistant tuberculosis suspects) CBNNAT investigation were enrolled under category II (98.1% cases and 97.1% study controls). It was observed that out of 102 drug resistant tuberculosis cases and out of 101 drugs sensitive tuberculosis cases relapse was the main reason to put study subjects on re-treatment (multidrug resistant cases 57.8% and drug sensitive cases 75.2%). Whereas cases who were on category I were 1.9%, these cases were suspected as MDR-TB cases based on their HIV status and history of contact with MDR TB cases.

Female patients from drug resistant categories were enrolled for re-treatment due to relapse (65.8%) and default (10.5%). Male patients were put on re-treatment categories mainly due to failure to previous treatment (39.1%). (Table-3)

Among follow-up sputum microscopic examination it was observed that those patients who have been subjected for follow-up sputum microscopic examination had 50.43 times chances for having MDR-TB in comparison with those who have subjected for sputum microscopic among drug sensitive cases. Whereas patients who underwent for follow up clinical examination was found border line association to have MDR-TB in comparison to drug sensitive cases.

Similarly DOTS under supervision, Consistent treatment under Intensive Phase and distance of DOTS provider were found to be inverse relationship for developing MDR-TB in comparison to drug sensitive cases. (Table-4)

### Table 1: Home visit of contractual staff paid before putting study participants for treatment

<table>
<thead>
<tr>
<th>visit of contractual staff</th>
<th>Cases</th>
<th>Controls</th>
<th>( \chi^2 ) &amp; ( p ) value</th>
<th>Cases</th>
<th>Controls</th>
<th>( \chi^2 ) &amp; ( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBHV</td>
<td>Male (%)</td>
<td>66 (63.5)</td>
<td>Female (%)</td>
<td>38 (36.5)</td>
<td>Total (%) 104</td>
<td>( \chi^2 ) &amp; ( p ) value</td>
</tr>
<tr>
<td>Yes</td>
<td>14 (21.2)</td>
<td>08 (21.1)</td>
<td>22 (21.2)</td>
<td>0.000</td>
<td>15 (22.7)</td>
<td>13 (34.2)</td>
</tr>
<tr>
<td>No</td>
<td>52 (78.8)</td>
<td>30 (78.9)</td>
<td>82 (78.8)</td>
<td>0.985</td>
<td>51 (77.3)</td>
<td>25 (65.8)</td>
</tr>
<tr>
<td>STLS</td>
<td>Male (%)</td>
<td>66 (63.5)</td>
<td>Female (%)</td>
<td>38 (36.5)</td>
<td>Total (%) 104</td>
<td>( \chi^2 ) &amp; ( p ) value</td>
</tr>
<tr>
<td>Yes</td>
<td>64 (97.0)</td>
<td>36 (94.7)</td>
<td>100 (96.2)</td>
<td>0.622*</td>
<td>62 (93.9)</td>
<td>37 (97.4)</td>
</tr>
<tr>
<td>No</td>
<td>02 (3.0)</td>
<td>02 (5.3)</td>
<td>04 (3.8)</td>
<td>4 (6.1)</td>
<td>01 (2.6)</td>
<td>05 (4.8)</td>
</tr>
<tr>
<td>DOTS Provider</td>
<td>Male (%)</td>
<td>66 (63.5)</td>
<td>Female (%)</td>
<td>38 (36.5)</td>
<td>Total (%) 104</td>
<td>( \chi^2 ) &amp; ( p ) value</td>
</tr>
<tr>
<td>Yes</td>
<td>64 (97.0)</td>
<td>38 (100.0)</td>
<td>102 (98.1)</td>
<td>0.532*</td>
<td>66 (100.0)</td>
<td>38 (100.0)</td>
</tr>
<tr>
<td>No</td>
<td>02 (3.0)</td>
<td>00 (0.0)</td>
<td>02 (1.9)</td>
<td>00 (0.0)</td>
<td>00 (0.0)</td>
<td>00 (0.0)</td>
</tr>
</tbody>
</table>

*Fischer’s exact test.

### Table 2: Distribution of study subjects according to preference of place to send sputum samples for investigation

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Cases</th>
<th>Controls</th>
<th>( \chi^2 ) &amp; ( p ) value</th>
<th>Cases</th>
<th>Controls</th>
<th>( \chi^2 ) &amp; ( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMC/PHC</td>
<td>Male (%)</td>
<td>33 (50.0)</td>
<td>Female (%)</td>
<td>21 (55.3)</td>
<td>Total (%) 54 (51.9)</td>
<td>0.695*</td>
</tr>
<tr>
<td>TU</td>
<td>13 (19.7)</td>
<td>04 (10.5)</td>
<td>17 (16.3)</td>
<td>16 (24.2)</td>
<td>04 (10.5)</td>
<td>20 (19.2)</td>
</tr>
<tr>
<td>DTC</td>
<td>11 (16.7)</td>
<td>08 (21.1)</td>
<td>19 (18.3)</td>
<td>12 (18.2)</td>
<td>08 (21.1)</td>
<td>20 (19.2)</td>
</tr>
<tr>
<td>OTHERS/IRL Pune</td>
<td>09 (13.6)</td>
<td>05 (13.2)</td>
<td>14 (13.5)</td>
<td>02 (3.0)</td>
<td>00 (0.0)</td>
<td>02 (1.9)</td>
</tr>
</tbody>
</table>

*Fischer’s exact test.
**Table 3: Distribution of study participants according to treatment profile before subjecting them to CBNAAT (n = 208)**

<table>
<thead>
<tr>
<th>Current treatment</th>
<th>Cases</th>
<th>Controls</th>
<th>( \chi^2 ) &amp; p value</th>
<th>( \chi^2 ) &amp; p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current treatment</strong></td>
<td><strong>Cases</strong></td>
<td><strong>Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (%)</td>
<td>Female (%)</td>
<td>Male (%)</td>
<td>Female (%)</td>
<td></td>
</tr>
<tr>
<td><strong>Total (%)</strong></td>
<td><strong>104</strong></td>
<td><strong>66 (63.5)</strong></td>
<td><strong>38 (36.5)</strong></td>
<td><strong>65 (98.5)</strong></td>
</tr>
<tr>
<td><strong>104</strong></td>
<td><strong>02 (1.9)</strong></td>
<td><strong>01 (1.5)</strong></td>
<td><strong>03 (2.9)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>CAT-I</strong></td>
<td><strong>02 (3.0)</strong></td>
<td><strong>00 (0.0)</strong></td>
<td><strong>00 (0.0)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>CAT-II</strong></td>
<td><strong>64 (97.0)</strong></td>
<td><strong>38 (100.0)</strong></td>
<td><strong>34 (33.3)</strong></td>
<td><strong>08 (12.3)</strong></td>
</tr>
<tr>
<td><strong>Cat-II</strong></td>
<td><strong>n = 102</strong></td>
<td><strong>n = 101</strong></td>
<td></td>
<td><strong>0.532</strong>*</td>
</tr>
<tr>
<td><strong>Relapse</strong></td>
<td><strong>34 (53.1)</strong></td>
<td><strong>25 (65.8)</strong></td>
<td><strong>59 (57.8)</strong></td>
<td><strong>45 (69.2)</strong></td>
</tr>
<tr>
<td><strong>Failure</strong></td>
<td><strong>25 (39.1)</strong></td>
<td><strong>09 (23.7)</strong></td>
<td><strong>34 (33.3)</strong></td>
<td><strong>12 (18.5)</strong></td>
</tr>
<tr>
<td><strong>Default</strong></td>
<td><strong>05 (7.8)</strong></td>
<td><strong>04 (10.5)</strong></td>
<td><strong>09 (8.8)</strong></td>
<td><strong>08 (12.3)</strong></td>
</tr>
</tbody>
</table>

*Fischer’s exact test.

**Table 4: Distribution of study subjects according to various program related influencing factors**

<table>
<thead>
<tr>
<th>Programme related factors</th>
<th>Cases N (%)</th>
<th>Controls N (%)</th>
<th>OR</th>
<th>( \chi^2 )</th>
<th>P value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sputum microscopic examination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Done</td>
<td>96 (92.3)</td>
<td>99 (95.2)</td>
<td><strong>0.606</strong></td>
<td>0.738</td>
<td>0.390</td>
<td>0.1914 to 1.919</td>
</tr>
<tr>
<td>Not Done</td>
<td>8 (7.7)</td>
<td>5 (4.8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Follow-up sputum Microscopic examination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Done</td>
<td>87 (83.7)</td>
<td>96 (92.3)</td>
<td><strong>0.426</strong></td>
<td>3.683</td>
<td><strong>0.055</strong></td>
<td>0.1753 to 1.038</td>
</tr>
<tr>
<td>Not Done</td>
<td>17 (16.3)</td>
<td>8 (7.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Follow-up x-ray chest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Done</td>
<td>95 (91.3)</td>
<td>18 (17.3)</td>
<td><strong>50.43</strong></td>
<td>114.8</td>
<td><strong>0.000</strong></td>
<td>21.515 to 118.22</td>
</tr>
<tr>
<td>Not Done</td>
<td>9 (8.7)</td>
<td>86 (82.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Follow-up clinical examination</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Done</td>
<td>100 (96.2)</td>
<td>93 (89.4)</td>
<td><strong>2.957</strong></td>
<td>3.521</td>
<td>0.061</td>
<td>0.9095 to 9.613</td>
</tr>
<tr>
<td>Not Done</td>
<td>4 (3.8)</td>
<td>11 (10.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Treatment Intensive phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistent</td>
<td>83 (79.8)</td>
<td>93 (89.4)</td>
<td><strong>0.467</strong></td>
<td>2.991</td>
<td>0.083</td>
<td>0.2127 to 1.027</td>
</tr>
<tr>
<td>Irregular</td>
<td>21 (20.2)</td>
<td>11 (10.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Continuous phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistent</td>
<td>91 (87.5)</td>
<td>84 (80.8)</td>
<td><strong>1.667</strong></td>
<td>1.297</td>
<td>0.254</td>
<td>0.7804 to 3.560</td>
</tr>
<tr>
<td>Irregular</td>
<td>13 (12.5)</td>
<td>20 (19.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DOTS under supervision</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>102 (98.1)</td>
<td>104 (100.0)</td>
<td><strong>0.196</strong></td>
<td>2.019</td>
<td>0.155</td>
<td>0.0092 to 4.139</td>
</tr>
<tr>
<td>No</td>
<td>2 (1.9)</td>
<td>0 (0.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Distance of DOTS provider</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2500 mts</td>
<td>82 (78.8)</td>
<td>70 (67.3)</td>
<td><strong>0.552</strong></td>
<td>2.957</td>
<td>0.085</td>
<td>0.2959 to 1.031</td>
</tr>
<tr>
<td>&gt;2500 mts</td>
<td>22 (21.2)</td>
<td>34 (32.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discussion

Majority of MDR cases (96.2%) and drug sensitive tuberculosis cases in current study (95.2%) were visited by the Senior tuberculosis laboratory supervisor (STLS), DOTS providers, Paid visits to 98.1% of cases and all the controls (100%). Tuberculosis health visitor paid the least visit to cases (21.2%) and controls (26.9%). The coverage by TBHV in the current study observed only at district headquarters and one of sub-district headquarters where medical college is located. Similarly Raazi J et al. also reported highly supervised treatment to both 62.22% cases and 85.16% controls by DOTS provider., Whereas Wahab F et al. reported that majority of MDR cases (46.7%) were supervised by General Practitioner and DOTS provider (40%). This high proportional of supervised treatment by contractual staff reveals that the current Revised National Tuberculosis Control Programme in Satara district is functioning as per Revised National Tuberculosis Control Programme guidelines which have resulted in very few defaulted cases.

For diagnosis and for follow up sputum examination, high proportion of sputum samples were sent to (51.9% MDR tuberculosis cases and 59.6% drug sensitive tuberculosis) Designated Microscopy centre at grass root level followed by Tuberculosis unit (16.3% cases and 19.3% controls), District Tuberculosis center (16.3% cases and 19.2% controls). Samples of MDR TB cases which were sent to Referral laboratories were higher than the drug sensitive cases (13.5 cases and 1.9% controls) specifically for culture and drug susceptibility test. As in India majority (80%) of population resides in rural area, and in existing study majority of cases belonged to rural area, maximum samples have been sent to DMC’s at grass root level (Primary Health Centers). Only for suspected cases of MDR tuberculosis, sputum sample were sent to referral laboratory for advanced method of investigation for MDR tuberculosis.

In the present study 98.1% of the cases and 97.1% of the controls were on Category-II treatment for tuberculosis. The main reason for re-treatment in our study was Relapse, followed by treatment failure and treatment after default. Similar findings pertaining to the relapse of present study was reported by Wang et al. (44.6% cases and 31.7% controls), Mukharjee P et al. (35.46% cases). The reason for relapse could be poor nutritional status, alcohol use, migration and co morbidities, such as, diabetes mellitus, HIV/AIDS infection may result in reinflection in previously cured/treated tuberculosis cases. However default cases were very few which could reflect functioning of RNTCP adversely.

Conclusion

The infrastructure to implement Revised National Tuberculosis Control programme at District level has fulfilled the guidelines of programme and function smooth and efficiently. All the contractual staff are working satisfactory as per the guidelines of Revised National Tuberculosis Control Programme, the distance to cover by DOTS provider is convenient for supervised treatment.

Source of Funding: This project was funded by OR Committee under RNTCP and all the investigations were sponsored by KIMSDU, Karad, Maharashtra.

Ethical Considerations: Ethical clearance was obtained from Institutional Ethics committee. Permission was obtained from District tuberculosis officer and State tuberculosis officer to conduct this study. Written informed consent was obtained from cases and controls in their local language Marathi before recruiting them in the study.

Conflict of Interest: The authors declare no conflict of interest regarding the publication of this paper.

Acknowledgements

I am thankful to KIMSDU, Karad, District Tuberculosis Officer, State Tuberculosis Officer and Operational Research Committee officials, Maharashtra for approving and sanctioning budget.

REFERENCES


Compressive Strength Evaluation between Metal Ceramic and Zirconia Crowns—An In-vitro Study

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1 Senior Lecturer, 2 Head of Department, 3 Professor, Department of Prosthodontics, Sree Balaji Dental College & Hospitals Chennai

ABSTRACT
The aim of this study is to evaluate the compressive strength of metal and zirconia cores and also the point of chipping of the veneered porcelain to both the core materials. For the present study, full coverage crowns were fabricated for mandibular molar. The crowns were divided into two groups. First group is five samples of metal ceramic crowns and second group is five samples of zirconia ceramic crowns. These crowns were subjected to static compression loading in a universal testing machine until the fracture of the veneering porcelain. The compressive load was recorded in newton. Data were subjected to student t test analysis. Mean compressive strength for group 1 metal ceramic crowns was 2587.80N and the mean compressive strength for group 2 zirconia ceramic crowns was 1361.00N. The compressive strength of metal when being used as a core material is significantly higher than zirconia. Under static compressive loading, the point of fracture of the veneered porcelains occurred at significantly lower values for the zirconia based restorations when compared to that of metal ceramic restorations.

Keywords: zirconia, metal ceramic, compressive strength, chipping.

Introduction
Fixed prosthodontic treatment involves the replacement and restoration of teeth by artificial substitutes that are not readily removed from the mouth. Its focus is to restore function, esthetics and comfort 1. For the past 40 years the porcelain-fused-to-metal systems have been extensively used in fixed partial dentures (FPDs) and still represents the gold standard. The advantages of the PFM systems are to combine the fracture resistance of the metal substructure with the esthetic property of the porcelain 2. The drawbacks of these restorations are that the bulk of the natural tooth may need to be sacrificed to provide adequate space to ensure adequate fracture resistance and aesthetics 3. However, recently the increasing demand for esthetic restorations as well as the questionable biocompatibility of some dental metal alloys has accelerated the development and improvement of metal-free restorations 4.

All ceramic restorations have become more widely distributed due to their high esthetic potential and their excellent biocompatible properties 5. Zirconia (ZrO2) is a ceramic material with adequate mechanical properties for manufacturing of medical devices 7. Since it was introduced in Dentistry, the polycrystalline zirconium dioxide (zirconia) resulted particularly attractive in prosthodontics, due to its excellent mechanical properties and improved natural-looking appearance compared to metal–ceramics. Zirconia stabilized with Y2O3 has the best properties for these applications. Zirconia is a crystalline dioxide of zirconium 10.

The first proposal of the use of zirconium oxide for medical purposes was made in 1969 12. Zirconia exhibits a phenomenon called “transformation toughening,” which disables the progress of crack growth and increases toughness against fractures 14. The tetragonal crystals of zirconium oxide are metastable and the stress applied to cracks or flaws can transform them into larger monoclinic crystals 13. Yttrium partially stabilized tetragonal zirconia poly crystal (3Y-TZP) is made of transformable t-shaped grains stabilized by the addition of 3mol% yttrium-oxide (Y2O3). Such a polycrystalline material exhibits low porosity and high density; at the moment it is the most popular and frequently used form of zirconia commercially available for dental applications 20.
**Compressive Strength**

In the study of strength of materials, the compressive strength is the capacity of a material or structure to withstand loads tending to reduce size. It can be measured by plotting applied force against deformation in a testing machine. Some material fracture at their compressive strength limit; others deform irreversibly, so a given amount of deformation may be considered as the limit for compressive load. Compressive strength is often measured on a universal testing machine.

Dental ceramic materials exhibit many desirable material properties, including biocompatibility, esthetics, diminished plaque accumulation, low thermal conductivity, abrasion resistance, and color stability. However, brittleness and low tensile strength are weak points of ceramic materials. Therefore, the clinical success of all-ceramic fixed partial dentures (FPD) has been disappointing, especially for posterior FPDs when compared with metal-ceramic restorations. Although metal frameworks have inherent disadvantages, studies reveal that the resistance to fatigue failure is comparatively more for metal ceramic restorations when compared to all ceramic restorations.

Porcelain materials present two problems associated with occlusal forces: fracture of the porcelain, which is dependent upon the size and direction of the force (e.g., normal chewing versus bruxing), the type of porcelain (e.g., feldpathic, versus lithium disilicate, versus zirconia), and the time of force application; and wear of the material and its antagonist, whether natural enamel or other restorative materials. This is dependent upon the type of porcelain, quantity and timing of force, glazed versus polished porcelain, and the nature of the antagonist.

**Method**

For the present study, full coverage crowns fabricated for mandibular first molar were tested for compressive strength. Materials used subjected to testing include:

1. Metal ceramic
2. Zirconia ceramic

In order to standardize the crowns, a conventional tooth preparation was done on a mandibular first molar typhodont tooth model (Nissin). A full arch mandibular impression tray was used to make impression of the prepared tooth model using Aquasil soft putty/regular set (DENTSPLY) and Aquasil ultra LV, type 3: light bodied consistency (DENTSPLY) using the double mix technique (fig 1). The impression was poured using type IV dental stone. The dies were casted in cobalt chromium alloy (fig 2).

**Bonding Casts to the Crowns:** Once fabricated, the crowns were bonded onto the metal dies (fig 4) using dual polymerization composite resin cement (Rely X U 200,3M.) and light cured for a period of 20 seconds for initial setting of the material (fig 5).

A force of 10 N was applied for 5 minutes to ensure even distribution of the bond material and seat the crowns properly. After the cement had set the excess cement were removed from the margins of the restoration.
Compression Testing: The compression testing was carried out using a universal testing machine (Instron model: WDW-100). The load applicator (4mm metal ball) descended onto the samples (fig 6) exercising a continuous force with a vertical cross head speed of 1mm/min, moving vertically downward perpendicular to the occlusal zone.

The load force applicator’s ball established three point contact with the slopes of the vestibular cusps. Static compression loading was carried out until chipping or fracture took place of the veneered porcelain to the corresponding core material. This value was recorded in Newton (N). The data obtained was tabulated and analyzed using student t-test analysis.

Results

Five samples were tested for compressive strength of metal ceramic in which chipping of veneering porcelain was at maximum of 2908N and minimum of 2300N.

Five samples were tested for compressive strength of zirconia ceramic in which chipping of veneering porcelain was at a maximum of 1500N and minimum of 1000N.

Mean values of compressive strength for metal ceramic and zirconia crowns were 2587.80 and 1361.0 N respectively. These values were subjected to independent student t-test analysis. The t-value obtained was 7.880 with degree of freedom (df) being 7.589. There was a statistically significant difference between the compressive strength of metal ceramic and zirconia crowns (p=0.000).

Discussion

With regard to biting forces in the oral cavity, compressive strength of materials used in fixed restorations plays a significant role in the durability and longevity of the prosthesis. Normal chewing cycle starts with opening movement from centric occlusion, lateral movement and closure on to working side. Then finally shear movement against slopes of the upper teeth to grind the food particles and bring the jaw back to centric occlusion. The para functional habits like clenching includes sustained amount of compressive forces in centric occlusion, whereas bruxing include sustained compressive and shearing forces.

The choice of compressive test type and its specific design used in this study is best suited to study the resistance of ceramic materials. These have been substantiated by numerous authors (Snyder et al, Panadero et al). The compressive testing would therefore appears to be a validated method for evaluating fracture resistance of crowns or fixed partial dentures. Furthermore the cross head speed (1mm/min) and static compressive load were established in light of a literature review dealing these variables.

Despite the many disadvantages of in vitro study it is important to evaluate isolated mechanical properties under standardized conditions and limited influencing parameters. Although compressive strength does not reproduce conditions in the oral environment as
faithfully as in vitro cyclic studies, the results of this type of test provide valid information, which can then be extrapolated in clinical practice.

All-ceramic crowns are subject to fracture during function. To minimize this common clinical complication, zirconium oxide is the material of choice used for the framework of all-ceramic crowns. Kelly suggested several recommendations for a clinically relevant in vitro load-to-failure test for all-ceramic restorations: use of a die material with elastic modulus similar to dentin, failure test under wet cyclic loading, preparation of the teeth or dies according to clinical guidelines and use of all-ceramic crowns with clinically relevant dimensions.

In the current study, some experimental conditions were different from Kelly’s recommendations. The elastic modulus of the die material in this study is higher than that of dentin. However, natural teeth are hard to be standardized in size, mineralization, internal cracks, pulpal chamber dimension, and mechanical properties and would have fractured under the high compressive loads exerted during the test. Clinically, restorations are subjected to dynamic complex loading in saliva, which contains both organic and inorganic components. These conditions are quite different from the conditions used in this study; thus, further investigation should be carried out using stress corrosion or corrosion fatigue methodology so that the long term performance of restorations can be predicted.

The typical failure pattern of a veneering material in the daily clinical practice is known as ceramic chipping. For metal ceramics restorations, the linear coefficient of thermal expansion for metal and ceramic must closely match to achieve a strong interfacial bond. A small mismatch between these two factors results in an unknown amount of residual stress at the interface. This stress is usually confined to the veneered porcelain only.

The bond between veneering ceramic and zirconia framework is currently the subject of comprehensive investigation, when compared to that of metal ceramic restorations and this forms the basis of this study. The results of the present study show that the point of chipping or fracture of the veneering porcelain for the metal ceramic restorations ranges from 2000 to 3000N. Subsequently the chipping for the zirconia based restorations ranges from 1000 to 1500N. There is a statistically significant difference between the two groups.

From the present in vitro study, it may be confirmed that porcelain veneers with the same characteristics behave in response to static loading differently depending on the type of core they cover. Zirconia restorations fracture at lower static load values. Porcelain veneer over a metal ceramic core resisted higher static loading.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Not required as it is an in-vitro study

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Evaluation of Thyroid Functions and Anti-Thyroid Peroxidase Antibodies in Patients with Vitiligo

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ABSTRACT

Vitiligo is a common skin disorder, and the pathogenesis is unknown. An increased prevalence of autoimmune thyroid diseases has been described in these patients. The aim of this study is to assess the prevalence of thyroid dysfunction and hypoparathyroidism in patients with vitiligo. One hundred and twenty patients (48 males and 72 females) with vitiligo were enrolled. Thyroid physical examination was carried out. Thyroid function tests, thyroid antibodies, calcium and phosphorus were assessed. The collected data were analysed. Thyromegaly was found in 32.1% of patients. Hypothyroidism was found in 18 (16.7%) out of 120 cases. Two of them had clinical and 14 had subclinical hypothyroidism. One patient had Grave’s disease. Antibody positivity was the most common disorder (anti-TPO and anti-tg were positive in 38.7 and 34.1%, respectively). No patient had hypoparathyroidism. Thyroid dysfunction, particularly hypothyroidism and thyroid antibodies increased in patients with vitiligo.

Keywords: Thyroid antibodies, thyroid dysfunction, vitiligo

Introduction

Vitiligo is one of the most common skin disorders with a prevalence of 1-2% in different populations. The condition occurs when pigmented cells are destroyed, causing patches of skin to lose their normal color and appear whiter.¹ ² The etiology of this disorder is not clear but different theories suggest that autoimmune, genetic disorders, toxic metabolites, oxidative stimuli are the main factors. The nervous system and or the absence of the melanocyte growth factor may be included.³

From these factors, autoimmune disorder is the most common cause and some of the patients have antibodies to melanocytes or melanocytic proteins. Although it is not confirmed that these antibodies cause disease or lead to melanocyte destruction, there is some evidence that cell-mediated immunity plays a role in melanocyte destruction.⁴ ⁶ Autoimmune thyroid diseases with prevalence of up to 30% accompany vitiligo, from which hypothyroidism is one of the most common disorder.¹ In a study of 121 children with vitiligo, 16% showed some abnormalities in the thyroid function tests, The antithyroid peroxidase antibody (Anti-tpo) was the most common disorder.¹ In other study, the prevalence of autoimmune disorders, including thyroid disease, was more common than that of the general population.² Dave et al showed that the frequency of thyroid disorders (endocrine and or immunologic or both) were 57.1% in people with vitiligo in comparison to 10% in people without vitiligo. Thirty-four percent of patients in their study had thyroid antibodies.⁷

Manighalam and colleagues conducted a study on 30 patients with vitiligo and they found hyperthyroidism and hypothyroidism in 10 and 6.6%, respectively.⁸ The aim of this study is to access the incidence of thyroid dysfunction and antithyroid antibodies in patients attending skin OPD with vitiligo.

Method

This was a prospective study conducted between 2012 and 2014 (2 year) in Santhiram Medical college and
General hospital, Nandyal. A total of 109 patients with vitiligo (38 males and 71 females) with a mean age of 34.4 ± 13 years were selected. Institutional ethics committee’s clearance was obtained prior to start of the study.

A dermatologist diagnosed the condition as vitiligo at least 5 months before the initiation of the study. All the patients underwent thyroidal physical examination for the presence of goiter.

Thyroid stimulating hormone (TSH), T3 and T4 were measured using the ELISA test (DRG-USA kit). The anti-TPO and anti thyroglobulin antibody (Anti-Tg) were measured using the ELISA test (DRG-USA kit) the normal range being below 30.

Serum calcium and phosphorus were measured in all patients, and if the results were abnormal, the measurement was repeated and parathyroid hormone (PTH) was measured as well.

**Statistical Analysis**

Student’s t-test/chi-square/and Mann-Whitney U tests were performed. All the data was analysed with SPSS, version 13.

**Results**

One hundred and twenty patients were enrolled. The mean age was 34.41 ± 13 (CI: 8-65) years [72 females (65%) and 48 males (35%)]. Seventy-eight patients had a normal thyroid size and 34 patients (30.1%) had goiter.

| Table 1: Laboratory investigations in patients with vitiligo |
|-----------------|-----|-----|
| Mean            | SD  | Range |
| TSH (mIU/L)     | 2.15| 0.3-3.5 |
| Anti-Tg (IU/ml) | 212 | <30    |
| Anti-Tpo (IU/ml)| 248 | <30    |
| Ca++ (mg/dl)    | 9.1 | 8.5-10.5 |
| P (mg/dl)       | 3.1 | 2.5-5.5 |

The laboratory findings are shown in Table 1.

Nineteen patients (17.4%) had abnormal TSH levels and in three patients (3.2%), the TSH level was less than normal, one patient had Grave’s disease and in another two patients, T3 and T4 were normal.

In 16 patients (15.7%), TSH levels were more than normal, and in 12 of them, it was more than 5 mIU/l. In these 16 cases, there were 12 females and 4 males. Two patients had clinical hypothyroidism. Anti-Tpo and anti-Tg antibody were positive in 41 (38.7%) and 37 (34.1%) cases, respectively. Thirty-four patients had goiter, from which 14 of them (42.4%) had abnormal TSH levels and this correlation was significant with Mann-Whitney U test (P = 0.002) and 21 of them (67.7%) had anti-Tpo antibody (P = 0.001).

There was a positive correlation between TSH and anti-Tpo antibody (r = 0.4, P = 0.002).

One case had serum calcium levels less than normal and two had increased serum phosphate levels, which was normal after tests was repeated and PTH was normal in all cases. Therefore, no patient had hypoparathyroidism.

**Discussion**

Vitiligo is a common skin disorder in which skin depigmentation is due to destruction of melanocytes and decreased melanin. Although the exact pathogenic processes involved in the destruction of melanocytes in vitiligo are still unknown, autoimmune melanocytic destruction have been advocated. This disorder always accompanies other autoimmune diseases, and the presence of autoantibodies is used to prove this theory.

We carried out this study in order to determine the association between autoimmune thyroid diseases, parathyroid disorder with vitiligo. Eighteen (16.7%) patients had overt thyroid disorders with hypothyroidism as the most common presentation and one patient had Grave’s disease. These results can be compared to those of other studies.

In a study that was performed on 121 children with vitiligo, nine patients had hypothyroidism and one patient had hyperthyroidism. In another study that was conducted in India, the thyroidal disorders were more common and in 35 patients with vitiligo, 40% had thyroidal dysfunction and 34.1% were anti-tpo antibody positive. In a research that was carried out on 30 patients with vitiligo in Iran, hyperthyroidism and hypothyroidism was observed in 10 and 6.6% cases, respectively. In a report, there was no thyroidal dysfunction, but the anti-tpo antibody positivity was more than that of the control group.

The important findings of this study were the increased positivity of anti-tpo and anti-tg antibodies.
38.7% and 34.1% of cases had elevated anti-tpo antibody and anti-tg antibody, respectively.

In other studies, the positive anti-tpo antibody and Anti-tg antibody were the most common disorders. In a study, the positive anti-tpo antibody was observed in 10% children; however, this can be due to the lower age group of this study, in which the children normally have lower antibody level than that of the adults.

In a study by Daneshpazhooh et al, increased anti-tpo antibody levels were found in approximately 18% of their patients.9 Although the frequency of positivity of anti-tpo antibody in their study was different to our findings, it could be due to the age group of their study sample and also female was more predominant in our study.

In a study in India, the anti-Tpo antibody was positive in 31.4% cases, which was similar to this study conducted in Andhra Pradesh. In a study that was conducted in UK in 40 patients, 34% had positive antithyroid antibody,11 and in a report from Australia, 106 patients 21% had positive antithyroid antibody.12 In Greece, in 54 children and adult cases with vitiligo, the prevalence of anti-tpo antibody was 24.1%.13

34 patients (301%) had some degree of goiter and most of them were women. Further, in another study that was performed, the prevalence of goiter was 20%.9

This may be due to high number of women in our study, who normally have more thyroid enlargement than men.

There are few studies that search the relation between vitiligo and hypoparathyroidism.

In a study by Betterle et al, the prevalence of autoimmune parathyroid disease in patients with vitiligo was 1%.14 There was no abnormalities in serum calcium, phosphorus and PTH levels; therefore, we did not detect any patients with hypoparathyroidism.

In conclusion, this study showed that the autoimmune thyroid diseases, most commonly hypothyroidism and autoimmune thyroiditis that are confirmed with the presence of antithyroid antibody, are more common in patients with vitiligo than general population.15

So we recommend the measurement of the TSH levels and anti-Tpo antibodies in all the patients with vitiligo and all of them who have a high level of anti-Tpo antibodies should be followed-up annually with TSH.

Source of Funding: Nil
Conflict of Interest: Nil

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The Incidence and Prevalence of Virulence Factors of Vaginal Candidiasis in Pregnant Women with Diabetes Mellitus

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¹Research Scholar, Department of Microbiology, ²Research Associate, Centre for Research, ³Professor of Biochemistry, ⁴Research Scholar, Department of Microbiology, Sri Lakshmi Narayana Institute of Medical Sciences, Affiliated to Bharath Institute of Higher Education, Pondicherry, India

ABSTRACT

Background and Purpose: Candida species are act as commensals, in antenatal women developed vaginal discharge which can lead to pregnancy difficulties like abortions, premature birth and other predisposing factors such as use of broad spectrum antibiotics, oral contraceptive pills and HIV/AIDS. The present study was aimed to the incidence and prevalence of virulence factors of vaginal Candidiasis in pregnant women with diabetes mellitus.

Materials and Method: Seventy five high vaginal swabs were collected from pregnant woman with symptoms of vaginal infection. These samples were tested by microscopical examination and culture on Sabouraud Dextrose agar to identified Phenotypic and Virulence factors of Candidia species

Results: Thirty five Candida species were isolated,66% non-albicans Candida species isolated, while Candida albicans were isolated 34% from total positive sample.Non-albicansCandida species were the predominant pathogens isolated. Biofilm production was shown by (88.5%) and phospholipase activity was given by (89%).

Conclusion: Nonalbicans Candida spp. increased production of virulence factors in VVC cases. Its isolation from clinical specimen do not ignored as nonpathogenic isolates or contaminant. Biofilm formation and other virulence markers should be routinely screened for vaginal Candidiasis during pregnancy with diabetes.

Keywords: Candidiasis, Vulvar erythema, Biofilm and Phopholipase.

Introduction

Vaginal Candidiasis is a abnormal growth of Candida species on the mucosa in the female genital tract. These clinical manifestations by occurrences of pruritus, hyperemria, vaginal discomfort,leucorrhea, dyspareunia and vulvar erythema may be due to in marital and sexual relations.¹ Usually vaginal Candidiasis is common due to altered pH and sugar content of vaginal secretions, increased estrogen level during pregnancy produces more glycoen in the vagina and it has direct effect on yeast cells causing to grow faster and stick more easily with the walls of vagina ² and also other predisposing factors such as use of broad spectrum antibiotics, oral contraceptive pills, HIV/AIDS, weakened immune system, topical use of antimicrobial agents.³ Besides, systematic conditions such as vitamin B deficiency, hypothyroidism and lymphoblastoma favours Candida infection.⁴

Pregnancies with diabetes mellitus are at higher risk of vaginal Candidiasis. Which is the second most frequent infection of the female genital tract.Up to 75% of all women will experience fungal vaginitis at some point in the lives and also 40 to 50%will experience a second episode of this disease.⁵ Symptoms of Candida infection in the vagina likes smelly, thick, white–yellow discharge that might be accompanied by itching, burning, swelling, walking, urinating and sex very painful.
Untreated vaginal infections can lead to pelvic inflammatory disease and scar the fallopian tube which can cause infertility. Candida albicans is the most common species isolated in diabetics. Recently, vaginal infection with non C. albicans species has been reported due to widespread and empirical use of antifungal drugs and virulence factors produced by Candida species.

In pregnancy, the recommended treatment is topical antifungal vaginal agents in the form of creams, suppositories and tablets, whereas oral therapy should not be used during pregnancy or breastfeeding. It was the view that every pregnant woman, symptomatic or asymptomatic, suffers from vaginal Candidiasis. Therefore, the present study was focused to incidence and prevalence of virulence factors of vaginal Candidiasis in pregnant women with diabetes mellitus.

Materials and Method

Study Design: A cross-sectional descriptive study was done among the pregnant women in Department of Microbiology, Clinical Pathology Laboratory, Sri Lakshmi Narayana Institute of Medical sciences, Pondicherry from January 2017-June 2017. This study comprised of 75 women of reproductive age group who were pregnant with diabetes. The study was approved by the institutional ethical committee of Sri Lakshmi Narayana Institute of Medical sciences, Pondicherry according Helsinki 1975 Human ethical guidelines. All the data were collected in a prescribed perform and obtained informed consent form from subjects. According to world health organization (WHO), diabetic affliction criterion was fasting blood sugar (FBS) higher than 140 mg/dl in two separate times. We administered a questionnaire to obtain information about: patient history. Women in their first trimester of pregnancy and previous history of preterm labor or spontaneous abortion. Those who had recently received the treatment for vaginal Candidiasis were excluded.

Specimen Collection and Processing: Two sterile cotton-tipped swabs were used to collect high vaginal discharge from the posterior fornix of the pregnant women with help of Speculum. One swab was used for preparation of smear for Gram’s staining and the other was inoculated on Sabouraud’s dextrose agar (SDA) slope containing chloramphenicol and incubated at 37°C up to 24h. Colonies suggestive of Candida spp. in SDA tube were further phenotypic methods and Other virulence factors such as phospholipase activity, proteinase activity, Haemolycic activity, esterase activity and Biofilm production.

Results

Table 1: Prevalence of Candidiasis among pregnant woman with DM

<table>
<thead>
<tr>
<th>Total no of sample</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>35(47%)</td>
<td>40(53%)</td>
</tr>
</tbody>
</table>

Table 2: Different scores of biofilm production by various Candida spp

<table>
<thead>
<tr>
<th>Biofilm</th>
<th>C.albicans (n = 12)</th>
<th>C.paralopsis (n = 9)</th>
<th>C.tropicalis (n = 4)</th>
<th>C.dublinosis (n = 4)</th>
<th>C.glabrata (n = 4)</th>
<th>C.krusei (n = 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>4(33.3%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Weak positive +</td>
<td>3(25%)</td>
<td>2(22%)</td>
<td>2(50%)</td>
<td>1(25%)</td>
<td>2(50%)</td>
<td>0</td>
</tr>
<tr>
<td>Moderate positive (++)</td>
<td>3(25%)</td>
<td>2(22%)</td>
<td>1(25%)</td>
<td>1(25%)</td>
<td>1(25%)</td>
<td>1(50%)</td>
</tr>
<tr>
<td>Strong positive (+++)</td>
<td>2(16.6%)</td>
<td>5(55.5%)</td>
<td>1(25%)</td>
<td>2(50%)</td>
<td>1(25%)</td>
<td>1(50%)</td>
</tr>
</tbody>
</table>

Table 3: Different PZ values of different Candida spp

<table>
<thead>
<tr>
<th>Phospholipase</th>
<th>C.albicans (n = 12)</th>
<th>C.paralopsis (n = 9)</th>
<th>C.tropicalis (n = 4)</th>
<th>C.dublinosis (n = 4)</th>
<th>C.glabrata (n = 4)</th>
<th>C.krusei (n = 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>1(8.3%)</td>
<td>2(22%)</td>
<td>0</td>
<td>0</td>
<td>1(25%)</td>
<td>0</td>
</tr>
<tr>
<td>Pz = (P)</td>
<td>6(50%)</td>
<td>6(67%)</td>
<td>3(75%)</td>
<td>3(75%)</td>
<td>1(25%)</td>
<td>2(100%)</td>
</tr>
<tr>
<td>Pz = (s.t p)</td>
<td>5(41.6%)</td>
<td>1(11%)</td>
<td>1(25%)</td>
<td>1(25%)</td>
<td>2(50%)</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 4: Different Prz values of different Candida spp

<table>
<thead>
<tr>
<th>Protease</th>
<th>C. albicans (n = 12)</th>
<th>C. paralopsis (n = 9)</th>
<th>C. tropicalis (n = 4)</th>
<th>C. dublinesis (n = 4)</th>
<th>C. glabrata (n = 4)</th>
<th>C. krusei (n = 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>2(17%)</td>
<td>2(22%)</td>
<td>1(25%)</td>
<td>0</td>
<td>3(75%)</td>
<td>0</td>
</tr>
<tr>
<td>Prz = (P)</td>
<td>7(58.3%)</td>
<td>5(56%)</td>
<td>3(75%)</td>
<td>2(50%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Prz = (sP)</td>
<td>3(25%)</td>
<td>2(22%)</td>
<td>0</td>
<td>2(50%)</td>
<td>1(25%)</td>
<td>2(100%)</td>
</tr>
</tbody>
</table>

Table 5: Different Esterase values of different Candida spp

<table>
<thead>
<tr>
<th>Esterase</th>
<th>C. albicans (n = 12)</th>
<th>C. paralopsis (n = 9)</th>
<th>C. tropicalis (n = 4)</th>
<th>C. dublinesis (n = 4)</th>
<th>C. glabrata (n = 4)</th>
<th>C. krusei (n = 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>2(17%)</td>
<td>1(11.1%)</td>
<td>3(75%)</td>
<td>0</td>
<td>1(25%)</td>
<td>0</td>
</tr>
<tr>
<td>Positive</td>
<td>10(83%)</td>
<td>8(89%)</td>
<td>1(25%)</td>
<td>4(100%)</td>
<td>3(75%)</td>
<td>2(100%)</td>
</tr>
</tbody>
</table>

Table 6: Different Haemolyase values of different Candida spp

<table>
<thead>
<tr>
<th>Haemolyase</th>
<th>C. albicans (n = 12)</th>
<th>C. paralopsis (n = 9)</th>
<th>C. tropicalis (n = 4)</th>
<th>C. dublinesis (n = 4)</th>
<th>C. glabrata (n = 4)</th>
<th>C. krusei (n = 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>1(8.3%)</td>
<td>4(44.4%)</td>
<td>2(50%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Positive</td>
<td>11(91.6%)</td>
<td>5(55.5%)</td>
<td>2(50%)</td>
<td>4(100%)</td>
<td>4(100%)</td>
<td>2(100%)</td>
</tr>
</tbody>
</table>

Discussion

Women motherhood is the most universal and strongest. The feeling of a life growing inside makes her ecstatic. Mother during pregnancy is very important to give birth to a healthy baby. About 75% of women of child-bearing age affects vaginal Candidiasis due to hormonal variation, i.e., during pregnancy, antibiotic uses and use of oral contraceptives. Women complain of vaginal release when they think it is unusual for them and if it symptoms like itching and discomfort.

The present study showed prevalence 47% of vaginal Candidiasis among pregnant women. Our founding similar to the observations of Tanzania and Menza et al also in agreement with our result which they reported that, prevalence of vaginal Candidiasis in among pregnant women were 42.9%, 42.7% respectively. In another study, by Feyi-Waboso and Ahmadi, where 42.9% of vaginal Candidiasis was found during pregnancy, this is maybe due to suppression of the immune system and prolonged and misuse of antibiotics which leads to the destruction of good and beneficial bacteria resulting to reduction of vaginal immunity.

The highest prevalence of vaginal infections in present study was noted among the age groups 21–30 years [56.2%], followed by 31-40 age group [50%] and >41 age group [20%]. This observation is consistent with Nelson et al showed a 60% frequency of Candidiasis in pregnant women of 26–35 years. Fifty five percent [55%] incidence rate was reported within age group 26 - 35 years in Benin City by Okungbowa et al. while Akortha et al reported 57% within age bracket 26 - 35 in Benin City, in Nigeria. The infection was at a higher frequency in this age group contains women are younger and sexually active have low vaginal defense mechanisms against Candida species. They have the habit of using contraceptives especially the emergency pills to prevent pregnancy. Present study found as the 41-45 years in ages of women VVC was less prevalence may be due to close to their menopause and are less active sexually and increased vaginal immunity.

It was obvious from this result; candida albican was the dominant isolated yeast [34%]. out of Candida species. The percentage of non-albicans species was 65.7%, composing of C.parapsilosis (26%), followed by C.glabrata (11%), Candida tropicalis (11%), Many of reports from different place in similar to our report, Shivan et al [18] in India, Rad et al [19] in Iran, reported that, C. albicans was the highest occurrence with [50%] and also observed by Isibor. C.parapsilosis as the most common Candida species among the symptomatic pregnant women in present study this results not similar.
to Altayyar IA et al showed candida albicans as the most common vaginal candida species followed by candida glabrata causing vaginal Candidiasis among pregnant women. C. parapsilosis, C.tropicalis C. kruzie may be due to pathogenesis and prognosis of candidal infections are affected by the host immune status.21

In the present study, multigravida suffered more significantly from vaginal candidiasis than the primigravida. this results similar to the Naheed Parveen et al.22 This finding can be explained as multigravida have longer sexual history and also number of pregnancies that make them more prone to develop vaginal candidiasis than primigravidae who have less sexual exposure. This present study revealed that most of the respondents had suffered from candidiasis in 2nd trimester of gestation period of 60% followed by 2ndtrimester with 37.1%. The study conducted by Oyewol et al.23 also observed the highest incidence of vaginal Candidiasis among pregnant women in their second trimester (61%). Deepa et al.,24 2014 reported 54% prevalence in second trimester, 30% in third trimester and 16% in first trimester. The highest number of VVC was observed in those of the respondents who had 66% symptoms of vaginal Candidiasis than 34%were asymptomatic A similar study was conducted by Kanagal et al.,25 reported 82% of Candida positive women were symptomatic and the remaining 18% were asymptomatic was in accordance with the present study.

Biofilm formation is a virulence factor due to the ability to confer resistance to antifungal therapy and protect the fungal cells from host immune responses. Shin JH, Kee SJ et al26 investigating biofilm production among Candida species detected higher levels of positivity among non-albicans Candida strains than that of C.albicans strains. Similar findings were reflected in the present study too.65.7% among non-albicans vs. 34% among albicans spp.

Phospholipases are a group of enzymes produced by Candida species that primarily help in digesting the phospholipids of the host cells leading to cell lyses. In this study, 41.6%, Candida albicans is the major producer of phospholipases while C. parapsilosis11%was the second most frequent species produced phospholipase in our study correlated with Nyirjesy, P et al 27.

In present study, C. albicans demonstrated increased capability of proteinase production and also noted in NAC spp. This enzyme facilitates Candida invasion and colonization of host tissue by disruption of host membrane and by degrading important structural and immunological defense proteins similar report by. Silva, M. et al study.28 Esterase act as virulence character among clinical isolates of Candida. Recent investigations suggest the mechanism of virulence is due to the cytotoxic effects of esterase in the host tissues. However, in present study find a significantly higher in esterase production among the non albicans Candida species this study comparison to few published reports C. P. G. Kumar, T et al.29

In current study, haemolyase production was noted in both C. albicans and NAC spp. It can activate complement and opsonize surface of red blood cells.30 Therefore, haemolyase is one of the important virulence factor contributing to pathogenicity of Candida. It enables the pathogen to survive and persist in the host.

Conclusion

The present study concluded that the high prevalence of vulvovaginal candidiasis in the pregnant women maybe due to abortions, premature birth, low birth weight and other morbidities. The higher incidence of vulvovaginal candidiasis found to be more especially within the age group of 21 to 30 years, in those women in their 2nd trimester of pregnancy. Non-albicans Candida species were the most prevalent vaginal Candida species isolated diabetes with pregnant women which indicates their emergence as opportunistic pathogens in immunocompromised patients. The emergence of nonalbicans Candida spp. increased production of virulence factors in VVC cases. Its isolation from clinical specimen can no longer be ignored as nonpathogenic isolate and dismissed as a contaminant. Therefore we recommended that biofilm formation and other virulence markers should be routinely screened for vaginal Candidiasis during pregnancy with diabetes.

Conflict of Interest: Nil

Source of Funding: Self

REFERENCES


Virulence Factors of Candida Species Isolated From Pulmonary Tuberculosis with Diabetes Mellitus

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1Research Scholar, Department of Microbiology, 2Research Associate, Centre for Research, 3Professor of Biochemistry, 4Associate Professor, Department of Physiology, 5Research Scholar, Department of Microbiology, Sri Lakshmi Narayana Institute of Medical Sciences, Affiliated to Bharath Institute of Higher Education, Pondicherry, India

ABSTRACT

Background and Purpose: Candida species are emerging as a potentially pathogenic fungus in pulmonary diseases. The synergistic growth promoting association of candida and mycobacterium tuberculosis has increased concern for studying the various candida spp. and its significance in pulmonary tuberculosis patients. This study was undertaken with the objective of discovering the study of virulence factors of Candida species isolated from pulmonary tuberculosis with diabetes mellitus.

Materials and Method: A total of 110 patients with pulmonary tuberculosis diagnosed by sputum Ziehl-Neelsen staining were included in the study. Candida co-infection was confirmed using the Kahanpaa et al. criteria. Candida species were identified using gram stain morphology, germ tube formation, morphology on cornmeal agar with Tween-80, sugar fermentation tests and HiChrom Candida Agar.

Results: Candida co-infection was observed in 53 (48%) of patients with pulmonary tuberculosis. Candida albicans was the most common isolate observed in 62% of the patients with co-infection, followed by C.parapsilosis (11.3%) and 5 were C. krusei (9.4%). Candida co-infection was found in 52.8% of female patients, while it was observed in only 47.1% of the male patients.

Conclusion: Candida spp. isolated from pulmonary tuberculosis patients has significantly higher production of virulence factors. Candida co-infection should be routinely practiced along with extracellular hydrolytic enzymatic activity and biofilm production of NAC Spp. The identification of the gene responsible for the colonization may provide novel targets for antifungal prophylaxis.

Keywords: Mycobacterium Tuberculosis, Candida infection

Introduction

Tuberculosis is a high morbidity and mortality disease in the world. One-third of the human population is infected with mycobacterium tuberculosis. The disease is treated with antibiotics on immunosuppressive agent which predisposes tuberculosis patients to immunocompromised and susceptible to fungal infections. Oral Candidiasis occurs most frequently in immunocompromised hosts, intensive care patients and patients undergoing chemotherapy.

The synergistic growth-promoting association of Candida and M. tuberculosis has also been documented experimentally. Mankiewicz (1954) et al study found that Mycobacterium tuberculosis has a syntropic relationship with Candida albicans where C.albicans was found to be growing on lowenstien Jensen’s medium for Candida albicans. Another study confirmed the effect of polysaccharide fraction of Candida albicans for enhancement of the growth as well as reduction of the generation time of tubercle bacilli.
Virulence factors of *candida* are adherence, pseudohyphae formation, phenotypic switching, biofilm production and proteinase and phospholipase production expressed by *Candida* species, which may vary depending on the type of infection, the site and stage of infection and the nature of the host response. Early data suggest that direct host cell damage and lysis are the main mechanisms contributing to fungal virulence. Therefore the present study was undertaken to determine the virulence factors of *Candida* species isolated from pulmonary tuberculosis with diabetes mellitus.

**Material and Method**

A total of 125 smear positive pulmonary tuberculosis patients were included in this study done during Jan-June 2016 at Sri Lakshmi Narayana Medical College, Pondicherry. The study was done after obtaining informed consent from the patients and institutional ethical committee clearance. Two consecutive sputum samples were collected from each patient and subjected to gram staining and culture.

A detailed history regarding smoking, alcohol consumption, calorie intake etc., was collected from the patients by administering a questionnaire. The criteria for diagnosis of *Candidiasis* were based on the presence of pus cells with budding yeast cells and pseudohyphae in direct gram stain. Samples were inoculated on Sabouraud’s Dextrose Agar (SDA). Colonies were identified by Phenotypic technique.

**Determination of Phospholipase Activity:** The culture medium consisted of 1 L of SDA broth add ten microliters of previously prepared yeast suspension was inoculated onto plates, incubated at 37 °C for 5 days in aerobic condition. The presence of enzyme activity was determined by the formation of a precipitation zone around the yeast colonies. Phospholipase activity (Pz) was calculated by dividing the diameter of the colony by the diameter of the colony plus precipitation zone. The Pz was scored as follows: Pz = 1, negative phospholipase activity; Pz = 0.64–0.99, positive phospholipase activity; and Pz ≤ 0.63, very strong phospholipase activity.10

**Determination of Proteinase Activity:** To bovine-serum albumin agar, add ten microliters of previously prepared yeast suspension and inoculated onto the plates, incubated at 37 °C for 10 days in both aerobic and anaerobic conditions. The presence of proteinase activity was determined by the formation of a transparent halo around the yeast colonies.11

**Haemolysin Activity:** Haemolytic activity was measured using blood agar plates. The *Candida* spp were streaked onto SDA enriched with 5 ml of human blood at pH 5.6 ± 0.2 and incubated for 5 days at 25°C. The plates were analyzed with the aid of a computerized image analysis system for all the assays and measurement of the zone of hemolytic activity.12

**Esterase Activity:** To determine esterase activity, Tween-80 opacity test medium was used add ten microliters of previously prepared suspension from each isolate was carefully deposited on the Tween-80 opacity test medium then incubated at 37 °C for 10 days in aerobic. Esterase activity was considered as positive in the presence of a halo pervious to light around the inoculation site.13

**Biofilm Production:** A loop full of organisms from the SDA inoculated into a tube containing 10ml Sabouraud’s liquid medium strains supplemented with glucose. The tubes were incubated at37°C for 24 h after which the broth was aspirated out and the walls of the tubes were stained with saffranin. Biofilm production was scored as negative (0), weak positive (1+), moderate positive (2+) and strong positive (3+). Data were entered in excel worksheets and analyzed using suitable statistical methods.14

**Results**

Out of the total 110 patients with suspected tuberculosis, 53 patients (48.1%) who were positive for acid fast bacilli by Ziehl-Neelsen stain were screened for *Candida* co-infection.

Out of 53 Candida species tested 37(69.8%) were found to be biofilm producers. Biofilm production was most frequent among non-albicans Candida 20 (37.7%) than Candida albicans 17(32.0%). Among the non-albicans Candida species, C. parapsilosis6 (30%) was the highest biofilm. (Table-1)

Phospholipase producers were more amongst the non-albicans Candida species 18(52.9%). C.krusei 5(27.7%) followed by 5(27.7%) C.dubliensiand 3(16.6%) C.tropicalis (Table-2). Proteinase production was most frequently among Candida albicans 28 (84.8%) than non-albicans Candida 10(50%). Among the non-albicans Candida species, C. tropicalis and C. krusei were found to be the highest producers.
albicans Candida species, C. tropicalis (30%) was the highest Protienase producer followed by C.dublinesis (30%) and C.krusei (20%) (Table-3). As shown in Table4,5 maximum Estarase and Haemolyase activity was seen Candida albicans.

<p>| Table 1: Biofilm production of Candida species |</p>
<table>
<thead>
<tr>
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<tr>
<td></td>
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</tr>
<tr>
<td>C.albicans (n = 33)</td>
<td>16</td>
</tr>
<tr>
<td>C.dublinesis (n = 5)</td>
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</tr>
<tr>
<td>C.tropicalis (n = 3)</td>
<td>0</td>
</tr>
<tr>
<td>C.krusei (n = 5)</td>
<td>0</td>
</tr>
<tr>
<td>C.glabrata (n = 1)</td>
<td>0</td>
</tr>
<tr>
<td>C. parapsilosis (n = 6)</td>
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<p>| Table 2: Phospholipase production of Candida species |</p>
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<tr>
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<tr>
<td>C.krusei (n = 5)</td>
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</tr>
<tr>
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<p>| Table 3: Protienase production of Candida species |</p>
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<td>C.tropicalis (n = 3)</td>
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<p>| Table 4: Estarase production of Candida species |</p>
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<td>C.glabrata (n = 1)</td>
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<td>C. parapsilosis (n = 6)</td>
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<p>| Table 5: Haemolyase production of Candida species |</p>
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<tr>
<td>C.tropicalis (n = 3)</td>
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<td>C.krusei (n = 5)</td>
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</tr>
<tr>
<td>C.glabrata (n = 1)</td>
<td>0</td>
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<tr>
<td>C. parapsilosis (n = 6)</td>
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</table>

**Discussion**

Pulmonary Tuberculosis has a wide range of clinical spectrum, chronicity and sequela. Several studies have been documented Candida species as the most common fungal agent isolated from sputum of pulmonary tuberculosis patients; its significance has always been a matter of controversy due to the fact that up to 32.5% of healthy people carry Candida in their throat as normal flora. This can contaminate the sputum sample during collection.\(^{15}\)

Present study shows the prevalence of 48.1% Candidal infection among the tuberculosis patients. Which is similar to Baradkar et al.\(^ {16}\) study showing prevalence of 26 % co-infection with Candida species. It is significantly higher in females than in males which is responsible for increased risk of Candida co-infection with pulmonary tuberculosis. According to Hidalgo et al.\(^ {17}\). colonisation rates of Candida species are equal in males and females.

In present study, the species-wise distribution of Candidal infections revealed the predominance of *Candida albicans* over other species of Candida. *C. albicans* constituted 62.2% of the total Candida isolates. This findings correlates with the Kali A et al study\(^ {18}\) which
also demonstrates *C. albicans* to be the commonest species causing secondary infection comprising 50% of the total Candida isolates.

In the present study, non albicans Candida 11%, 9.4%, 9.4%, 5.6% and 2% prevalence for *C. parapsilosis*, *C. dubliniensis* *C. krusei*, *C. Tropicalis* and *C. glabrata* respectively. This result is similar with studies of Ndukwu, C et al detected *Candida*. These variations mainly due to differences in local prevalence of different species depending on different environmental conditions.

Amphotericin B, belongs to the polynene class of antifungal agents and also most effective treatment for fungal infections. In present study, 23(70%) *C. albicans* and non albicans candida, 5(100%) *C. dubliniensis* 3(100%) *C. tropicalis*, 4(80%) *C. krusei*, and 4(66.6%) *Candida parapsilosis* resistance to amphotericinB. This results correlated with Sanandaj (1.6%) and Ahvaz (4%). 2.6%7% in Shiraz and Mazandaran were observed highest resistance rates to this antifungal agent due to nephrootoxicity in up to 80% of the patients. It can positively affect the immune system and stimulates the body defenses against fungal infections.23

Susceptibility of 85% *C. albicans*, 100% *C. dubliniensis*, 100%, *C. tropicalis*, 100% *C. krusei*, and 83.3% *Candida parapsilosis* to fluconazole in this study comparable with 80.9%, Badiee P, Alborzi Aet al.9 9% Lord AM, North TE, et al.24 87.5% Ozcelik B This anti fungal agents more cost effective and less toxic forms of theazole family with excellent patient tolerance.28

*Candida* biofilms may help maintain the role of fungi as commensals and pathogen by evading host immune mechanisms, resisting antifungal treatment and the competitive pressure from other organisms. Our data showed that biofilm production was more significant among non-albicans Candida species 37.7% than *C. albicans* 32.0%. Similar findings have been reported by Girish, and Muni et al. Among the non albicans Candida species, the biofilm positivity occurred most frequently among isolates of *C. parapsilosis* (30%), followed by *C. krusei* (20%) and *C. tropicalis* (15%) were produced strong slime producers this results correlated with Daget al. Hetal Sida et al.

In our study phospholipase activity was noted 52.9% of NAC spp. Minimum phospholipase production was seen in *C. tropicalis* (16.6%) which is similar to the observation of Thangam et al.30 These variation may be due to different strains or the difference in the method of media preparation and discrepancy observed by different workers in the phospholipase activity of the NAC spp.

Proteinase activity was seen in Candida albicans 84%. The correlation between production of proteinase and virulence shows that, the most virulent NAC spp. like *C. tropicalis* produces more proteinases in-vitro. This observation was similar to given reports by Ghannoum MA et al.

Haemolyase activity more significant among the candida albicans than non albicans candida species in the present study. Marcos-A riaserose et al.32 found that non-candida species also produced same type of haemolytic activity. In the oral cavity, extracellular iron bound mainly to lactoferrin, a protein present in saliva. while intracellular iron is stored as ferrit in although, this elements bound to protein and is present in the cytoplasm of cells. Oral infection with C.albicans are frequently suggesting that this yeast is able to take up different forms of iron from the oral cavity. About 90% of Candida albicans expressed esterase activity in present study this results correlated with pakshir et al. and aktas et al.

**Conclusion**

Our findings indicate that Candida spp. isolated from pulmonary tuberculosis patients has significantly higher production of virulence factors. The production of phospholipase and proteinase activity is responsible for the proliferation and demolition of the host tissues. Haemolytic and esterase activity was observable in all the isolates. Significance biofilm formation higher in non-albicans Candida species than *C. albicans*. This ability to form biofilms is intricately linked with the ability of the organisms to adhere, colonize and subsequently cause infection in susceptible individuals. The resistance rate is increasing towards amphotericin-B drug by C. albicans. Therefore, screening of Pulmonary tuberculosis patient for *Candida* co-infection should be routinely practiced along with extracellular hydrolytic enzymatic activity and biofilm production of NAC Spp. would be an important tool to prove the relation between the infective species of Candida infection. The identification of the gene responsible for the colonization may provide novel targets for antifungal prophylaxis.
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A Study on Physico-Chemical Characteristics of Ground Water in Aligarh and Agra District Uttar Pradesh, India

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ABSTRACT

Water is a chemical union between hydrogen and Oxygen. Water is unique in the sense that it can exist in three phases at almost the same temperature: Solid state (ice), liquid and gas (water vapour). On the earth, about 2/3 of the surface is covered by water and about 1/3 by land. So, water is a basic, natural resources for agriculture and industry. The present study was conducted to analyze the physico-chemical properties of groundwater from ten locations in Aligarh and Agra district of Uttar Pradesh. The samples were analyzed for seven water quality parameters in post monsoon season during the year 2017. The study area has a mean of pH 7.65, Total alkalinity 1002.2 mg/l, Electrical Conductivity 2.57 µS/m, Total Dissolved Solids 650.4 ppm, COD 94.2 mg/l, BOD 0.89 mg/l, and Fluoride 0.85 ppm. The results obtained from chemical analysis were compared with standard namely Bureau of Indian standards (BIS). From the analysis it has been observed that the drinking water quality in the study area is reasonably not good and it does show any alarming level of pollutants, however it needs some degree of treatment before use for drinking and other purposes. It also needs to be protected from the industrial waste and sewage contamination.

Keywords: Water, Physico-chemical properties, Groundwater Quality, Pollutants.

Introduction

Water is the most important and useful natural resources on the earth because life is not possible without water. Water is essential for the survival of all living organisms and plays an important role in our life. But unfortunately the deficiency of the clean water increases day by day due to pollution of water and overexploitation, so the drinking water analysis is very important and essential for public health studies. Ground water is the major source of water for drinking, agricultural and industrial need. The availability of water determines the location and the activities of human beings in an area, and our growing population is placing great demand upon natural fresh water resources. It is estimated that approximately one third of the world’s population depends on ground water for survival. The physicochemical contaminants that adversely affected the quality of ground water is likely to arise from various sources, including land application of fertilizers, infiltration of effluent from sewage treatment plants, industrial waste, ponds, etc. The water supply for human consumption is often directly sourced from ground water without chemical treatment and it is used by humans so the pollution of ground water has become a cause for major concern. Pollution of water is due to increased human population, use of fertilizers in agriculture, industrialization and human activity. Once the ground water is contaminated, its quality cannot be restored by stopping pollutants from the source therefore it becomes very important to regularly monitor the quality of ground water. In recent years, because of rapid urbanization, growing population and industrialization, the rate of discharge of pollutants into the environment is higher than the rate of purification which ultimately finds their

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way into these water bodies\textsuperscript{8,10}. It is believed that surface water are generally more polluted than ground water, hence the use of ground water such as borehole water as the major source of drinking water in many areas is the only alternative\textsuperscript{4,5}. Unfortunately, ground water can also be polluted through various ways such as fertilizer from agricultural and mining activities, seepage from effluent waters, vehicle maintenance, domestic waste and sewage disposal \textsuperscript{6,11}. The study of physic-chemical properties of Bore well water quality in Vidharbh Region, Nagpur city south zone was carried out and concluded that some parts of bore well water needed treatment for drinking water purpose due to hardness, pH, DO, Alkalinity and Chlorides are present in desirable limits and some sort little variation\textsuperscript{4}. The various physic-chemical parameters were evaluated to study the suitability of ground water mainly for drinking purpose in Taj city Agra and found that the water quality of all samples is not suitable for drinking without treatment. The evaluation of physico-chemical parameters was carried out to assess the quality of ground water and concluded that the ground water of Kurnool region is fit for domestic use and drinking purpose but need treatments to minimize the contamination especially the alkalinity.

The present work is an attempt to analyze the physico-chemical parameters of drinking water samples collected from different sites in Aligarh and Agra district, India to assess the ground water quality and it is fit or not for drinking purpose.

**Materials & Method**

**Study Area:** Agra city is situated on the bank of river Yamuna in the northern state of Uttar Pradesh, India. Agra city is famous for Taj Mahal. The city is 378 km west of the state capital Lucknow 206 km south of the national capital New Delhi. The city is the administrative district of Agra district. Agra district is situated in western Uttar Pradesh, between 27.11\textdegree North and 78.0\textdegree to 78.2\textdegree longitude East.

Aligarh is a city in the northern Indian state of Uttar Pradesh and the administrative headquarters of the Aligarh district. The city lies 203 km northwest of Kanpur and is 140 km southwest of the capital New Delhi. Aligarh is located at the coordinates 27.88\textdegree N 78.08\textdegree E. It has an elevation of approximately 178 meters (587 feet). The city is in the middle portion of the doab.

**Methodology**

In the present study, ten ground water samples were collected from different locations of Aligarh and Agra district, Uttar Pradesh. The sampling points are located in such a way that, they are uniformly distributed in all the wards of the study area. Mostly, bore wells are considered for sampling. At certain places a few open wells and hand pumps are also considered for the sampling. The water samples were collected in clean plastic bottles without any air bubbles. The bottles were cleaned before collecting sample and tightly sealed after collection of sample and labeled in the field. Samples were analyzed immediately for parameters, which need to be determined instantly and rest of samples were refrigerated at 28\textdegree C to be analyzed later. Analytical grade and chemicals were used to prepare reagents and calibration standards. Water samples are collected from each sampling point and are analyzed for the parameters shown in Table1.

**Table 1: Methods used for estimation of Physico-chemical parameters**

<table>
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<tr>
<th>S. No.</th>
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<th>Methods</th>
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<td>2.</td>
<td>Electrical Conductivity</td>
<td>Digital conductivity meter</td>
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<td>3.</td>
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</tr>
<tr>
<td>5.</td>
<td>COD</td>
<td>Open reflux method</td>
</tr>
<tr>
<td>6.</td>
<td>BOD</td>
<td>Titration method</td>
</tr>
<tr>
<td>7.</td>
<td>Fluoride</td>
<td>Ions selective electrode method</td>
</tr>
</tbody>
</table>

**Results and Discussion**

1. **Potential of Hydrogen Ion (pH):** The permissible limit of pH for drinking water is 6.5-8.5\textsuperscript{2}. It was seen that the pH value of the water appears to be dependent upon the relative quantities of calcium, carbonates and bicarbonates. The water tends to be more alkaline when it possesses carbonates \textsuperscript{12}. The pH value of the samples in the study area varied from 6.75-9.4 with a mean of 7.65 indicating slightly alkaline nature.

2. **Electrical Conductivity (EC):** Electrical conductivity is a measure of water’s capacity to
conduct electric current. Most of the salts which are present in water in ionic form are responsible to conduct electric current. Electrical conductivity value of the study area varied from 1.70-4.76 µs with a mean of 2.57 µs and most of the samples were shown low value from the standards of ICMR/BIS prescribed for drinking.

3. **Total Alkalinity (TA):** The permissible limit of alkalinity for drinking water is 200-600 mg/l. The excess of alkalinity could be due to the minerals, which dissolved in water from mineral rich soil. The various ionic species that contribute mainly to alkalinity includes carbonates, bicarbonates, phosphates, hydroxides, borates, silicates and organic acids. In some cases, hydroxides or ammonia are also accountable to the alkalinity. The alkalinity of the samples in the study area varied from 750-1500 mg/l as CaCO$_3$ with a mean value of 1002.2 mg/l as, CaCO$_3$ indicated high alkaline nature of water in the study area and all the samples were found exceeding the acceptable limit of ICMR/BIS.

4. **Total Dissolved Solids (TDS):** The permissible limit of TDS for drinking water is 500-2000 ppm. Total dissolved solids are present due to the concentrations of all minerals in water and indicate the general nature of salinity of water. TDS in groundwater originate from natural sources, sewage, urban runoff and industrial wastes. Based on TDS ground water is classified as follows:

- a. Non-saline $< 1000$ TDS in mg/l
- b. Slightly saline 1000-3000 TDS in mg/l
- c. Moderately saline 3000-10000 TDS in mg/l
- d. Very saline $> 10000$ TDS in mg/l

Total Dissolved Solids of the samples in the study area varied from 301-1025 ppm with a mean value of 650.4 ppm and most of the samples were found within the permissible limits of ICMR/BIS.

5. **Chemical Oxygen Demand (COD):** Chemical Oxygen Demand is a measure of pollution in aquatic system. High COD may cause oxygen depletion on account of decomposition by microbes to a level detrimental to aquatic life. COD values of the ground water samples in the present study area varied from 75-150 mg/l with a mean of 94.2 mg/l and some samples were found exceeding the acceptable limit of ICMR/BIS. It may be due to seepage from sewage drainage or industrial discharge in nearby localities.

6. **Biological Oxygen Demand (BOD):** Biochemical Oxygen Demand is supposed to measure the amount of food (or organic carbons) that bacteria can oxidize. In the present study BOD values of various ground water samples were found from 0.4-1.4 mg/l with a mean of 0.89 mg/l and half of the samples were found exceeding the acceptable limit of ICMR/BIS.

7. **Fluoride (F):** The fluoride in the ground water samples of the study area varied widely from 0.6-1.0 ppm with a mean of 0.85 ppm and most of the samples were found below with the permissible limits of ICMR/BIS.

**Conclusion**

Analysis of water samples collected from various locations of Aligarh and Agra city revealed that all water samples do not comply with BIS standards and Indian Standards- 10500-91. The results of the study are presented in the following Table 2 & 3. The following observations are made from the results.

Table 2: Comparison of physico-chemical parameters at different sites in Aligarh and Agra city with Bureau of Indian Standard (BIS)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Physico-chemical Parameters</th>
<th>BIS Range</th>
<th>Aligarh</th>
<th>Agra</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>pH</td>
<td>6.5-8.5</td>
<td>7.3-9.4</td>
<td>6.5-7.20</td>
<td>Need for Treatment</td>
</tr>
<tr>
<td>2.</td>
<td>Electrical Conductivity (µS/m)</td>
<td>300</td>
<td>1.70-4.76</td>
<td>2.31-2.37</td>
<td>Need for Treatment</td>
</tr>
<tr>
<td>3.</td>
<td>Total Alkalinity (mg/l)</td>
<td>200-600</td>
<td>950-1500</td>
<td>750-950</td>
<td>Need for Treatment</td>
</tr>
<tr>
<td>4.</td>
<td>Total Dissolved Solid (ppm)</td>
<td>300-600</td>
<td>301-866</td>
<td>707-1025</td>
<td>Need for Treatment</td>
</tr>
<tr>
<td>5.</td>
<td>Chemical Oxygen Demand (mg/l)</td>
<td>30</td>
<td>75-102</td>
<td>50-150</td>
<td>Need for Treatment</td>
</tr>
<tr>
<td>6</td>
<td>Biological Oxygen Demand (mg/l)</td>
<td>2.3</td>
<td>0.4-0.8</td>
<td>1.1-1.4</td>
<td>No Need for Treatment</td>
</tr>
<tr>
<td>7</td>
<td>Fluoride (ppm)</td>
<td>1-1.5</td>
<td>0.6-1.0</td>
<td>0.8-1.0</td>
<td>No Need for Treatment</td>
</tr>
</tbody>
</table>
Table 3: Values of physico-chemical parameters at different sites in Aligarh and Agra city

<table>
<thead>
<tr>
<th>Location</th>
<th>pH</th>
<th>E. C. (3-4 µS/m)</th>
<th>Alkalinity (mg/l)</th>
<th>TDS (ppm)</th>
<th>COD (mg/l)</th>
<th>BOD (mg/l)</th>
<th>Fluoride (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sikandra</td>
<td>6.75</td>
<td>2.37</td>
<td>750</td>
<td>707</td>
<td>150</td>
<td>1.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Dayalbhag</td>
<td>7.05</td>
<td>3.37</td>
<td>805</td>
<td>1025</td>
<td>100</td>
<td>1.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Sadar</td>
<td>7.13</td>
<td>2.31</td>
<td>812</td>
<td>683</td>
<td>100</td>
<td>1.0</td>
<td>0.85</td>
</tr>
<tr>
<td>Near Taj Mahal</td>
<td>7.31</td>
<td>2.37</td>
<td>950</td>
<td>707</td>
<td>50</td>
<td>1.1</td>
<td>1</td>
</tr>
<tr>
<td>Collectrate</td>
<td>7.20</td>
<td>2.55</td>
<td>850</td>
<td>763</td>
<td>95</td>
<td>1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Dodhpur</td>
<td>9.4</td>
<td>1.70</td>
<td>1500</td>
<td>301</td>
<td>85</td>
<td>0.6</td>
<td>1</td>
</tr>
<tr>
<td>Sasni Gate</td>
<td>8.6</td>
<td>4.76</td>
<td>1300</td>
<td>866</td>
<td>102</td>
<td>0.4</td>
<td>0.7</td>
</tr>
<tr>
<td>Quarsi</td>
<td>8.3</td>
<td>1.83</td>
<td>1100</td>
<td>342</td>
<td>75</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Jeevangargh</td>
<td>7.5</td>
<td>1.96</td>
<td>1005</td>
<td>370</td>
<td>90</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Jamalpur</td>
<td>7.3</td>
<td>2.51</td>
<td>950</td>
<td>740</td>
<td>95</td>
<td>0.6</td>
<td>1</td>
</tr>
<tr>
<td>Mean</td>
<td>7.65</td>
<td>2.57</td>
<td>1002.2</td>
<td>650.4</td>
<td>94.2</td>
<td>.89</td>
<td>0.85</td>
</tr>
<tr>
<td>Max.</td>
<td>9.4</td>
<td>4.76</td>
<td>1500</td>
<td>1025</td>
<td>150</td>
<td>1.4</td>
<td>1</td>
</tr>
<tr>
<td>Min.</td>
<td>6.75</td>
<td>1.70</td>
<td>750</td>
<td>301</td>
<td>75</td>
<td>0.4</td>
<td>0.6</td>
</tr>
</tbody>
</table>

(Where E.C.-Electrical Conductivity, TDS- Total dissolved solids, COD- Chemical Oxygen demand, BOD- Biochemical oxygen demand, Max. - Maximum, Min. – Minimum.)

1. The pH of the samples is found to be varying from a minimum value of 6.75 in Sikandra to a maximum value of 9.4 in Dodhpur area.

2. Electrical Conductivity is found to be more in the wards Sasnigate a indicating high TDS concentration in groundwater of these areas. Conductivity varied from a minimum of 1.70 micro-seimans In Dodhpur to a maximum of 4.76 micro-seimans in Sasnigate.

3. Total Alkalinity is found to be more varying from a minimum of 750 mg/l in Sikandra to a maximum of 1500 mg/l in Dodhpur.

4. Hardness is found to be more in the Dayalbhag areas. The maximum and minimum values are found to be 1025mg/l in Dayalbhag and 301mg/l in Dodhpur.

5. Fluoride concentration is varied from a minimum of 0.6 mg/l in Jeevangarh to a maximum of 1.0 mg/l in near Tajmahal.

6. COD levels are found to be in the permissible limits and they varied from a minimum of 75 mg/l in Quarsi to maximum of 150 mg/l in Sikandra.

7. BOD levels are found to be in the permissible limits and they varied from a minimum of 75 mg/l in Quarsi to maximum of 150 mg/l in Sikandra.

For the above analysis that the study emphasizes the urgent need for regular underground water quality monitoring to assess pollution activity from time to time for taking appropriate measures in time to mitigate the intensity of pollution activity. Augmenting the groundwater resources by recharging the ground water aquifers through rain water harvesting and other Techniques such as remote sensing and GIS and thus reducing the high concentration of the chemical parameters is a very important measure. Public awareness program should be initiated to create a sense of awareness to save water around their habitants. It also needs to be protected from the industrial waste and sewage contamination.

Ethical Clearance: Taken from ethical committee of Mangalayatan University, Beswan, Aligarh

Source of Funding: Self

Conflict of Interest: The authors declare no conflict of interest.

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Understanding Autoimmunity—A Brief Review

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ABSTRACT

There is increasing evidence of immune diseases in the last few decades. Immune reaction doesn’t occur against our own tissue antigens. This is as a result of “Tolerance to self-antigens” which is acquired by varied mechanisms. Failure in immune recognition of self and injury to self-tissues (autoimmunity) results from a loss of self-tolerance. This article will discuss the mechanisms of self-tolerance and the break down mechanism in autoimmunity.

Keywords: autoimmune, antigen, self tolerance, rejection, immune recognition

Introduction

Autoimmunity is the breakdown of mechanism responsible for tolerance and induction of immune response against component of self-molecule ¹. The body’s immunological mechanism is dependent on two factors, (i) The inactivation and rejection of foreign substances (ii) The ability to differentiate between the body’s own antigen (self) and foreign substance (non self). Usually reaction doesn’t occur against our own tissue antigens. This can be due to “tolerance to self-antigens” that is nonheritable by varied mechanisms like bacterial, viral, chemical, genetical etc. Failure in immune recognition of self and injury of self tissues (autoimmunity) results from a loss of self-tolerance. Various mechanisms of self tolerance and the break down mechanism lead to autoimmunity.

Mechanisms of Self Tolerance: The various mechanisms of self tolerance include i) central tolerance by clonal deletion. This mechanism involves elimination or inactivation of those T and B cells that recognize self-antigens. There is also inactivation of developing lymphocytes in our immune system which becomes self-tolerant, these self-antigens of specific lymphocytes are either deleted or inactivated. Clonal inactivations are often mediated by tissue-specific antigens. ii) T Lymphocyte tolerance mechanisms: T cells recognize pathogen on the surface of MHC molecules on host cells²,³. The T cells has the potential to damage the healthy tissue when they fails to recognize the foreign antigen i.e when they respond to self-antigens instead of to foreign antigens. Failure of T-cell tolerance can lead to many autoimmune diseases. The tolerance of T- cells begins in the thymus. Tolerance mechanisms before the maturation and circulation of T cells in the thymus are referred to as “central T cell tolerance.” But, not all antigens that T cells tolerate are expressed in the thymus. The tolerance mechanisms which act on mature circulating T cells after they leave the thymus are referred to as “peripheral T cell tolerance.” iii) B cell tolerance mechanisms: B-cell Tolerance is little different from that of the T cells. Immature B cells tolerance mechanism in the bone marrow is referred to central B cell tolerance. Antigen recognized B cells are eliminated via apoptosis and become anergic, but not all autoreactive B-cells are eliminated in the bone marrow. B-cells are T-cell dependent. T dependant B cells are pre-activated by auto reactive T-cells antigen and becomes self-reactive. This
occurs in the secondary lymphoid tissue and is referred to as peripheral B cell tolerance.

Another mechanism of self-tolerance is that the Fas-mediated programmed cell death (apoptosis) of non-reactive B lymphocyte following secondary encounter with CD4 T lymphocyte. Apoptotic cell clearance is basically important because otherwise apoptotic cells tend to become necrotic and provoke inflammation and autoimmune response in our immune system. It is been estimated that more than 109 cells undergo apoptosis daily and are cleared rapidly by the phagocytes.4

**Mechanisms for Breakdown of Self Tolerance:** Self Tolerance is kept in normalcy by various regulatory interactions of a variety of cells and mediators. However there are certain conditions, tolerance can be broken resulting in an autoimmune pathology may result. There is also loss of “Self Tolerance” germinal centers because of some genetic aberration or some environmental factors.

1. **Major histocompatibility complex (MHC) molecules** usually ought to present the peptide (antigen) to T cells for immune reaction to occur.5 The amount of auto antigenic peptide residues in MHC molecules is responsible for the affinity of peptide binding. If the peptide is conferred at low levels to interact the effector T cells, there will be tolerance to self-antigens and if peptide is presented at terribly high levels then they undergo deletion or anergy. Hence people with a specific autoimmune disorder tend to express identical antigens with a similar MHC. Breakdown of tolerance arises most often to tissue-specific antigens with solely bound MHCmolecules.

2. **Gene mutation/s** results in one or additional response diseases. Response diseases are related to specific MHCgenotypes.6 The most established association is with specific alleles within the MHC gene complex.

3. **Environmental factors** which might cause breakdown of self-tolerance include pathogens (microorganisms), drugs, hormones, toxins and others.
   - Drugs: Drug induced lupus
   - Toxins. Eg: Toxic oil syndrome (musculoskeletal disease caused by contaminated colza oil)

4. **Complement Deficiency:** Deficiencies in the classical complement pathway renders the possibility to develop immune complicated diseases7,8 eg: Systemic Lupus Erythematosus and Rheumatic syndromes.

5. **Molecular Mimicry:** Many peptide fragments identical with host proteins induce auto immune response (organ-specific). β-hemolytic streptococcus bacteria has a high degree of homology with cardiac myosin. The antibodies that target bacteria cross-react with cardiac muscle and induce rheumatic fever. The other example will be Autoimmune thyroiditis (Grave’s disease).

Generally autoimmune diseases are divided into two groups: 1) the organ-specific autoimmune diseases, in which the target antigens and disorders are localized in one specific organ, and 2) the systemic autoimmune diseases, in which antigens are expressed widely in the body. There are also autoimmune diseases which stands between these two groups which results either from the same or different mechanisms. Though there are various other factors associated with the progression of autoimmune diseases, epitope spreading is one such important factor of the autoimmune disease progression. Epitope spreading is a phenomenon in which autoantigens (antigen determinants) detected by T and B cells increase during the process from the initial activation of autoreactive lymphocytes to the chronic phase. This concept is very important mechanism by which autoimmune response induced by one cryptic epitope leads to complete autoimmune response. Particularly, B cells play a very vital role as antigen-presenting cells for T cells.10

In addition nutrition deficiency also plays a major role in immune response. Deficiency of vitamins (eg., vitamin A, vitamin D) and minerals (zinc) leads to functional impairment of the T cells, phagocytic cells and antibody response.11 Considering these factors, it is very important to distinguish specific autoimmune responses which cause various autoimmune diseases from the existence of autoreactive lymphocytes or simple autoimmune response.
Conclusion

Autoimmune diseases are a significant health problem because of their chronic nature. They can be limited to particular tissues or sometimes be disseminated. Autoimmune disease state is characterized by a specific antibody or cell mediated immune response against the body’s own tissue (auto antigen). There are multiple factors involved in establishment of either an immune response or a state of unresponsiveness to an antigen. There are also a number of different ways in which a breakthrough of tolerance can occur leading to autoimmunity. Understanding these processes will offer us a better insight into the pathogenesis of autoimmune diseases and would aid to control and manipulate the therapeutics of the disease and their autoimmune responses.

Conflict of Interest: None

Source of Funding: Self

Ethics Committee Approval: Not required as it is a review

REFERENCES


Evaluation of Hematological and Biochemical Parameters in Dengue

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ABSTRACT

Background: Dengue is one of the most common arboviral infection in the world. Evaluation of the clinical parameters for the early diagnosis of the disease is used to assist the preventive strategies. This study aimed to evaluate the hematological and biochemical parameters retrospectively in patients with serologically confirmed dengue infection over a one-year period.

Method: The study was conducted in clinical laboratories of a tertiary care hospital serving the people of Karnataka and neighbouring states. A retrospective analysis of known IgM and anti-NS1 seropositive dengue patients over a period of one year was done to evaluate the hematological and biochemical data for any significant variations.

Results: A total of 108 patients were studied. 100 (92.60%) patients had Dengue Fever, 4 (3.70%) had Dengue haemorrhagic Fever, and 4 (3.70%) had Dengue Shock Syndrome. Thrombocytopenia in 87 (80.60%) cases, elevated AST in 92 (85.2%) and raised CK/CPK level observed in 50% of the cases.

Conclusion: The alterations in hematological and biochemical parameters is associated with the patient case history and the clinical diagnosis.

Keywords: Dengue, arboviral infection, hemorrhagic fever, platelet count, hematological parameter

Introduction

Dengue is an acute arboviral infection characterized by nonspecific symptoms such as headache, fever, body ache, prostration, skin rashes, lymphadenopathy and leukopenia followed break bone fever. Because of regular temperature fluctuations in the patient, the disease is also known as saddle back fever ¹. The infection is caused by one of the four serotypes of the dengue virus DEN-1, DEN-2, DEN-3 and DEN-4 that belongs to the genus Flavivirus of the family Flaviviridae².

It is most common mosquito-borne viral disease worldwide³, approximately 100 million of dengue fever cases and 250,000 - 500,000 cases of Dengue Hemorrhagic Fever are reported to the World Health Organization annually³. DEN-2 serotype of the virus was predominant in India during the last major DHF outbreak in 1996. However, the extensive research during the period since 2002, highlights the presence of all four serotypes, with predominance of DEN-2 and DEN-3 serotypes⁴.

The common risk factors for infection are increased density of the mosquito vector along with increased human population ⁵. Viremic patients are potentially infectious during the febrile phase of the infection. However several studies in community have revealed that the use of mosquito net and screening was effective in preventing the disease transmission.⁶

The disease is asymptomatic in majority of the patient, few develop Dengue Fever (DF), Dengue Hemorrhagic Fever (DHF), and DHF with Dengue Shock Syndrome

(DSS); where DHF/DSS has a high mortality rate. Early clinical features are variable often non-specific; hence, specific laboratory tests are necessary for an accurate diagnosis of Dengue infection. Thus, acute dengue infection is often unrecognized until the appearance of the more specific symptoms that leads to late inadequate treatment. To avoid these complications early diagnosis by evaluating laboratory parameters is important for the appropriate treatment which ensures marked reduction in the morbidity of Dengue fever. The objectives of present study is to evaluate the hematological parameters and biochemical markers as predictors of dengue fever and its severity.

**Materials and Method**

The study was conducted at the tertiary care hospital of South India which is serving predominantly the people of Karnataka and the patients from neighboring states. In this retrospective study we reviewed 108 known IgM anti-NS1 seropositive cases of dengue infection over a period of one year from July 2013 to August 2014. The seropositive cases were confirmed from the concerned virology department in the hospital. The hematological and biochemical parameters of all the patients with confirmed dengue infection irrespective of their age were analyzed during the period of hospital admission. Statistical frequency analysis method was used to analyze all the descriptive data in the study. Dengue seropositive patients with other co-infections like malaria, typhoid and/or any other pathological conditions were excluded from the study.

**Result**

In 108 dengue seropositive patients, 72 (66.70%) were males and 36 (33.30%) were females with male to female ratio of 2:1. Table 1 shows that 92.60% patients were with dengue fever. Following Udupi, most of the cases were from Davanagere, Shimoga and Haveri districts of Karnataka.

Analysis of the blood samples taken for complete blood counts (CBC) on the day of admission is recorded. Leucopenia was observed in 38 (35.2%) patients. Thrombocytopenia was found in 87 (80.60%). The hematocrit values and hemoglobin concentration was found to be low in 24 (22.2%) patients.

<table>
<thead>
<tr>
<th>Types of dengue infection in seropositive patients</th>
<th>Male</th>
<th>Dengue Hemorrhagic Fever</th>
<th>Dengue Shock Syndrome</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>68</td>
<td>2</td>
<td>2</td>
<td>72</td>
</tr>
<tr>
<td>Female</td>
<td>32</td>
<td>2</td>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>4 (3.70%)</td>
<td>4 (3.70%)</td>
<td>108</td>
</tr>
</tbody>
</table>

The peripheral smear study showed varied impression in ruling out the effect of dengue infection. Polychromasia in 36 (33.30%) and anisocytosis was observed in 42 (38.90%), presence of poikilocytosis was seen in 6 (5.60%) cases.

In the leukocyte differential count (DLC), compared to lymphocytes, a relative neutrophil count was low in 47 (43.50%). In this, 65 (60.20%) patients showed Left Shift/immature forms of neutrophils, 14 (13.0%) patients with toxic changes and 6 (5.60%) cytoplasmic vacuolation.

The lymphocyte count was found to be high in 36 (33.30%) and low in 33 (21.20%) in patients and 63 (58.30%) had reactive forms, 36 (33.30%) atypical forms, 4 (3.70%) of the patients had plasmacytoid forms.

Monocyte count in the peripheral smear was high in 19 (17.60%) and low in 24 (22.20%), the eosinophil count was low in 69 (63.90%). Basophil count was low in 95 (88.0%). Band forms were present in 40 (37.0%) cases.

Both AST and ALT levels were high in 92 (85.2%) and 56 (51.9%) patients respectively. Majority of the patients had normal whereas 18 (16.7%) patients had high ALP level. The direct and total bilirubin tests were reported, direct bilirubin was high in 27 (25.0%), Total bilirubin was high in 22 (20.4%) and low in 26 (24.1%) patients.

Serum total protein level was found to be low in 28 (25.9%) cases. In 29 (26.9%) patients had low level of albumin and globulin was found normal in 94 (87%). High level of muscle enzymes; creatine kinase (CK) and creatine phosphokinase (CPK) was observed in 54 (50%) patients. The sodium (Na+) level was low in 54 (50.0%) patients.
The high urea level was found in 16 (14.8%) patients and serum creatinine level was high in 9 (8.3%) of the patients.

During the hospital stay, 4 patients were expired in which one patient had dengue fever; other patients had suffered with DHF and DSS respectively.

Discussion

A range of outcomes in the analysis of hematological and biochemical parameters were seen during dengue viral infections. The incidence of dengue was remarkably high during monsoon9, which was re-established in our study. The important clinical hallmarks in dengue virus infection in patients is thrombocytopenia, frequently occurring at the febrile stage10. Dengue virus induces aberrant activation of the immune system and cytokine (IL-6) overproduction leading to enhanced production of anti-platelet and anti-NS1 (nonstructural protein-1 antigen) antibodies cross-reacting with human platelets11. The leukopenia associated with dengue is mainly due to the reduction in the neutrophils. Presence of atypical lymphocytes with activated lymphocytes and plasma cells along with thrombocytopenia have been reported consistently along with other laboratory findings12. In any viral infections, eosinophil concentrations will be decreased in response to inflammation during the acute phase13. Patients with either primary or secondary dengue infections exhibit a fall in the leukocyte count12. Normocytic Normochromic RBCs have found in most of the cases with raised hematocrit levels, but polychromasia, anisopoikilocytosis, rouleaux forms also observed in some cases12.

The liver is one of the target organs for dengue and clinical manifestations of hepatic dysfunction can occur during the course of this disease5. The liver is deprived of oxygen leading to lesions of the parenchyma, in which the injured hepatocytes release transaminases that is detectable in the peripheral blood. The liver enzymes, ALT and AST are used as diagnostic markers for dengue fever14. Higher transaminase level was associated with greater morbidity and mortality irrespective of grade of dengue. Serum bilirubin has not raised significantly whatever the transferase levels were; which is very peculiar in dengue15.

There is a direct and indirect evidence of biochemical alterations related to severity of dengue. Studies have reported that patients with DHF have elevated serum levels of transaminases: aspartate aminotransferase (AST) and alanine aminotransferase (ALT) and creatine kinase (CK)16. Hypoalbuminaemia may, however, be as a result of enhanced impairment of the synthetic function of the liver by dengue infection since it has liver as its target organ14. Plasma leakage, may also causes hypoalbuminemia, is an indicator of severity16. Elevation of muscle enzyme CPK may be due to subclinical myositis16. Infrequently unusual encephalitic signs have been associated with electrolyte and metabolic disturbances17. Our results suggest that these alteration in these parameters can predict a more severe form of dengue and could also be indicate early tissue injury in the acute phase of dengue infection. Changes in serum urea and creatinine levels are indicative of renal dysfunction. Renal function alterations are seen only in few patients in our study14.

Conclusion

The alterations in hematological and biochemical parameters is associated with the patient case history and the clinical diagnosis. This could help in predicting the infection, treating the patient and monitoring the prognosis, before it is too late until the specific test results are obtained.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Ethical clearance was obtained from Institutional ethical committee, MAHE, Manipal

REFERENCES


ABSTRACT

Introduction: Dialysis catheters are commonly used as temporary vascular access in hemodialysis individuals. These catheters are referred to as irreplaceable tool because of their significant role in providing easy and instant access to the circulation for delivery of Hemodialysis under diverse clinical situations. The most common complications associated with dialysis catheter includes mechanical and or infectious resulting in early catheter removal, morbidity and or mortality. Although Catheter Related Blood Stream Infection (CRBSI) is reported to have an adverse impact on quality of life, survival and healthcare cost, dialysis catheters are quite frequently used for vascular access till date. It is essential for dialysis unit to have database on the CRBSI to minimize the risks of CRBSI and thereby improve life quality.

Aim: To investigate CRBSI associated with non-tunneled dialysis catheters in a tertiary care hospital.

Objectives: (a) To compare infection between the types of non-tunneled dialysis catheters (b) To compare the infection across the gender

Method: Prospective observational study. A total of N=633 individuals with non tunnelled dialysis catheter, undergoing HD for the period of eight months were enrolled in the study. Participants prospectively followed up for evidence of CRBSI post insertion of catheter until the point of catheter removal or the completion of the study. Descriptive statistics was used to analyse the data. Mann Whitney U test was used as test of significance to compare between the groups with p<0.001.

Result: This study had 37 CRBSI individuals. The infection rate differed across the types of nontunneled dialysis catheters and infection observed was predominant among the males as compared to females.

Conclusion: It can be concluded that the incidence of CRBSI was observed more in internal jugular vein dialysis catheters as compared to femoral vein dialysis catheters possibly due to extension of the catheters in situ among the participants enrolled in the study.

Keywords: Hemodialysis, CRBSI, Dialysis catheters, vascular access, Non tunnelled dialysis catheter, Non tunnelled femoral vein dialysis catheter, Non tunnelled Internal jugular vein dialysis catheter, Quality of life.

Introduction

Haemodialysis (HD) aids in sustaining life among three general conditions that includes Acute Kidney Injury (AKI), End-Stage Renal Disease (ESRD) and poisoning. A Successful HD in any of these conditions needs access to large blood vessels efficient of facilitating speedy extracorporeal blood flow. The aim of vascular access is to deliver frequent access to the...
circulation with least complications. Dialysis catheters (DC) are commonly used as temporary vascular access in haemodialysis individuals. These catheters are referred to as irreplaceable tool, although not favoured yet it is unavoidable because of their significant role in providing easy and immediate access for delivery of haemodialysis under diverse clinical situations. The most common complications with dialysis catheter includes mechanical and or infectious resulting in early catheter removal, morbidity and or mortality. Although Catheter Related Blood Stream Infection (CRBSI) is reported to have an adverse impact on quality of life, survival and healthcare cost, dialysis catheters are quite frequently used for vascular access till date. It is essential for dialysis unit to have database on the CRBSI to minimize the risks of CRBSI and thereby improve quality of life.

CRBSI is defined as the bacteremia or fungemia in individuals with no apparent source for the bloodstream infection, except for the catheter in individual with dialysis catheter (CDC 2002). It is diagnosed based on clinical manifestations of infection, positive blood culture obtained from a peripheral vein, and the same organism must exist from the catheter segment and peripheral blood. The risk of developing CRBSI varies with several factors that include DC site insertion, type of device, duration of DC, comorbid deficits and other confounding clinician and client related variables [1].

Generally, non-tunnelled Dialysis Catheters (NTDCs) are inserted in a descending order of preference into the internal Jugular vein dialysis catheter (NTIJVDC) (<3weeks) or Non Tunnelled Femoral Vein Dialysis Catheter (NTFVDC) (<1 week) when immediate vascular access is required to start an emergency HD for a short period (<1 week-3 weeks) use. Both of these types of NTDCs are associated with a higher incidence of infections and thrombosis as compared to all other types of vascular access [2][3]. Regardless of all of these factors, NTDC remains as an obligatory tool for immediate vascular access creation till date. Therefore it is essential for every dialysis unit to have a database on the CRBSI to minimize the risks of CRBSI and thereby improve quality of life. Hence the present study was attempted to investigate the frequency of CRBSI across the type of NTDCs among the HD individuals.

**Aim:** To investigate CRBSI associated with non-tunnelled dialysis catheters in a tertiary care hospital

**Objectives:** (a) To compare infection between the types of non-tunnelled dialysis catheters (b) To compare the infection across the gender

**Method**

The present study was a Prospective observational study. The study was approved by the IEC committee (IEC Ref: 67/2013). It was conducted in the Department of Nephrology, tertiary care hospital. Informed Consent was obtained from the participants.

**Participants:** All individuals undergoing HD through NTFVDC and NTIJVDC for AKI/ESRD were included in the study. The participants enrolled were in the age range of 17 to 78 years. The individuals who were dialyzed through the tunneled catheter, arteriovenous fistula, arteriovenous graft and who exhibited with any other source of infection were excluded from the study.

A total of 633 participants, who had undergone HD treatment through NTFVDC and NTIJVDC were enrolled in the study for the period of eight months from January 2013 to August 2013. All DCs were inserted as per the Hospital Infection Control protocol under aseptic techniques. The participants had prospectively followed up post catheter insertion for the evidence of CRBSI until the point of catheter removal or until the completion of the study. The participants’ data were retrieved from the database. The data included demographic details, type of catheter, catheter duration period, intradialytic complications like chills, fever, and hypotension, exit site infection. It also included data related to blood test, culture sensitivity test, causative agent, and medication.

**Procedure:** The dialysis catheter during the HD procedure was handled by experienced staff (more than 5 years) using sterile technique. The catheter lumens were aseptically flushed with 0.9% sterile normal saline solution and locked with heparin at the end of each HD session. The catheters were not filled with any other thrombolytic agent or antimicrobial solution. Each individual is monitored for the presence of any infection at the catheter site, exudation upon catheter insertion, and symptoms such as fever, shivering, and chill during every session of HD. Two peripheral blood samples were collected and blood and/or catheter-tip cultures were monitored for the individuals who had signs and symptoms of CRBSI. The participants identified with CRBSI were further investigated for variation in gender and site of catheterization. Descriptive statistics was used to analyse the data. Mann Whitney U test was used as test of significance to compare between the groups with p<0.001.
Result

In the present study, 5.84% (37/633) exhibited CRBSI, identified based on clinical symptoms and or microbiological investigation. Among the participants, 35.1% were female and 64.9% were male.

Table 1: Total number of participants (Non CRBSI and CRBSI)

<table>
<thead>
<tr>
<th>Variable</th>
<th>NTDC</th>
<th>NTFVDC</th>
<th>NTIJVDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>n = 633</td>
<td>n = 385 (60.8%)</td>
<td>n = 248 (39.2%)</td>
</tr>
<tr>
<td>CRBSI</td>
<td>n = 37 (5.84%)</td>
<td>n = 5 (0.78%)</td>
<td>n = 32 (5.05%)</td>
</tr>
<tr>
<td>Male</td>
<td>24/37 (64.9%)</td>
<td>3/5</td>
<td>21/32</td>
</tr>
<tr>
<td>Female</td>
<td>13/37 (35.1%)</td>
<td>2/5</td>
<td>11/32</td>
</tr>
<tr>
<td>Non CRBSI</td>
<td>n = 596</td>
<td>n = 380</td>
<td>n = 216</td>
</tr>
</tbody>
</table>

*NTDC- Non Tunnelled Dialysis Catheter; NTFVDC- Non Tunnelled Femoral Vein Dialysis Catheter; NTIJVDC- Non Tunnelled Internal Jugular Vein Dialysis Catheter

Table 2: Comparison across types of non tunnelled catheters

<table>
<thead>
<tr>
<th>Variable</th>
<th>NTFVDC</th>
<th>NTIJVDC</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>n = 385 Catheter days 3469</td>
<td>n = 248 Catheter days 4044</td>
<td>n = 633 Catheter days 7513</td>
</tr>
<tr>
<td>CRBSI</td>
<td>n = 5 (0.78%) Catheter days 39</td>
<td>n = 32 (5.05%) Catheter days 1211</td>
<td>n = 37 (5.84%) Catheter days 1250</td>
</tr>
</tbody>
</table>

*NTFVDC- Non Tunnelled Femoral Vein Dialysis Catheter; NTIJVDC- Non Tunnelled Internal Jugular Vein Dialysis Catheter

In the present study, CRBSI was observed across the types of non-tunneled dialysis catheters. The infection rate was higher with the duration of catheter in situ among the participants as depicted in table 2.

The other findings observed during dialysis treatment were chills (9 participants), fever (29 participants) and exit site infection (14 participants). The commonest HD complication found was fever with chills during the treatment. The lab test findings were low hemoglobin (7.55%) and albumin level (2.72), increased white blood count (22 participants) and neutrophils (15 participants). The blood culture test report was found to be positive among 37.83% (14/37) CRBSI cases. The common causative bacteria found among the participants were Methicillin-Resistant Staphylococcus Aureus (MRSA), Staph. Aureus and Coagulase Negative Staphylococci (CONS).

Mann-Whitney u test was done to compare between the CRBSI and non CRBSI Non tunneled internal jugular vein dialysis catheter. The test result revealed significant difference in the average number of catheter days between the two groups as depicted in table 3.

Table 3: Average number of catheter days in CRBSI & non CRBSI groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases</th>
<th>Catheter days</th>
<th>Median (q1,q3)</th>
<th>Significance P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTIJVDC CRBSI</td>
<td>32</td>
<td>1211</td>
<td>29 (12.75, 46.75)</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>NTIJVDC non CRBSI</td>
<td>216</td>
<td>2833</td>
<td>8(4.25, 16)</td>
<td></td>
</tr>
</tbody>
</table>

*NTIJVDC- Non Tunnelled Internal Jugular Vein Dialysis Catheter
Discussion

CRBSI is a serious and common most complication of the DC which will cause morbidity and mortality in patients undergoing hemodialysis treatment [2][3]. In individuals undergoing chronic hemodialysis, CRBSI is a leading cause of hospitalization and mortality [3][4][5]. In this study, definite diagnosis of CRBSI was done by a combination of the clinical signs and symptoms, blood tests and the catheter tip cultures. In the present study, it was observed that 37 participants among 633 exhibited (5.84%) CRBSI which is less as compared to the previous study stating of 15% of CRBSI [6]. As per KDOQI guidelines, CRBSI incidence should be <10% at three months and 50% at one year [7]. Individuals using a DC for vascular access will have a high risk of CRBSI and it increases in a true fashion with the length of catheter days [1]. It is well documented regarding the persistence of CRBSI infection in the literature. However, in the present study, the infection rate was observed to be less as compared to other studies[8][9]. This could be possibly attributed to the clinical practices with an effective infection control program in the dialysis unit. In the present study, CRBSI was observed to be more in NTIJVDC as compared to NTFVDC which is contrary to other studies wherein they observed the CRBSI be higher in NTFVDC[10][11][12]. This could be probably due to catheter being in situ for a longer duration [11][13][14]. In present study, the infection rate was observed to be predominant among males as compared to females which are in accordance with [14]. This could be probably due to ignorance of males in self-hygiene as most of the time they are dependent on their spouse/caretakers and denying the advice of removing the catheter within the recommended timeline.

Clinical Implication: The Clinical implication of this study is to develop an infection surveillance program with dedicated personnel and resources to facilitate the identification of catheter-related infections and timely interventions to reduce infection rates improve patient clinical outcomes.

Conclusion

The rate of infection may vary with the site of catheter insertion. The risk of infection increases with the duration of the catheter in situ. An effective infection control program could attempt to minimize the risk of CRBSI associated infection. Further investigations involving multidisciplinary teams are essential so that suitable measures can be executed in the clinical services to prevent bacteremia and other complications associated with infection as a consequence of dialysis catheter.

Limitation and Future Directions: The present study limits with its observational pattern, lack of data for participants who were discharged against medical advice and the importance of low threshold for diagnosis of CRBSI based only on the clinical features. There is a dire need for further studies to focus on interventions that will favorably affect the CRBSI outcomes.

Acknowledgement

We would like to express our sincere gratitude to Dr. Manohar Bairy G. Consultant Nephrologist, Tan Tock Seng Hospital, Singapore for his valuable suggestions and guidance to complete this study.

Conflict of Interest: None declared.

Source of Funding: This study was not funded.

Ethical Clearance: The study was approved by the IEC committee (IEC Ref: 67/2013). It was conducted in the Department of Nephrology, Kasturba Hospital, Manipal, Karnataka, India. Informed Consent was obtained from the participants.

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Nutritional Status of Preschool Children (3-5Years) Attending Anganwadi in Selected Urban Slum Areas of Karad

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ABSTRACT

Background: As cities are developing in India, urban slums are also increased with people moving from rural areas to urban in search of better life with job but live over crowdedly in urban slums with poor environmental sanitation. Children in the slum suffer from malnutrition caused by lack of food and inadequate Knowledge of mothers on nutrition. Nutrition of preschool children is paramount importance; because the foundation for life time health, strength and intellectual vitality is laid during this period.

Aims: To assess the “Nutritional Status of preschool children (3-5Years) attending anganwadi in selected urban slum areas of Karad, and to find the association between nutritional status and demographic variables of preschool children.

Materials and Method: A community-based cross-sectional study was conducted in 6 Anganwadis at urban slum areas of Karad. Non-probability purposive sampling technique was used for selecting 137 preschool children. Nutritional status was assessed using anthropometry. Undernutrition was classified using Indian Academy Pediatrics (IAP). The data collected, tabulated and analyzed as per the objectives of the study using descriptive and inferential statistics.

Results: Assessment of Nutritional Status shows that 60.58% of children were normal, 31.39% of children were suffering from Grade I malnutrition and 8.03% of children were suffering from Grade II malnutrition and none of them were suffering from Grade III and IV malnutrition.

Conclusion: Respite of many programmes providing nutritional supplements through ICDS programme still prevalence of undernutrition in preschool children is high so there is need for improvement in nutritional status through nutrition education of mothers and empowerment of mothers through education and economically through providing employment and improving living conditions and environmental sanitation in the urban slum areas.

Keywords: Nutritional Status, preschool children (3-5Years), anganwadi, urban slum, Karad.

Introduction

Global population is expected to grow from 6.7 billion to 9.2 billion between 2007 and 2050. According to United Nation(2010) today, approximately 828 million urban populations are living in slum areas, compared to 657 million in 1990. Urban slums are exacerbated with over-crowding, with polluted water, lack of sanitation, pollution, open sewage and contamination affecting the child and household health. Acute and chronic malnutrition of underfive children are comparable with or higher than, the rates in rural underfive children.¹

Population in urban slum of less developed countries will be expected to double to almost two billion people by 2030. Children in slums are at high risk of undernutrition, which has long-term negative consequences on their physical growth and cognitive development².
Rapid industrialization has resulted into phenomenal growth of urban slum settlements in many big cities of India in the recent past. Slum populations living in adverse conditions represent nutritionally vulnerable groups that need immediate attention. Under-nutrition remains a major problem in most developing countries, especially in urban slums.

Childhood malnutrition is a global public health problem with serious consequences for both individual and society. Malnutrition is one of the major public health problems in India. Major causes of morbidity and mortality among under-five children is chronic undernutrition - stunting. Malnutrition continues to be a growing problem in almost all developing countries. Eighty percent of undernourished children in the world live in 20 countries, with India being home to nearly 60 million children who are underweight.

Maternal and Childhood undernutrition is currently the single leading cause of the global burden of undernutrition. More than one-third of the world’s undernourished children live in India.

Malnutrition has a long-term impact on physical and intellectual development of a child. Addressing nutritional problems of urban poor living in slums is of paramount importance for overall development.

Problem of malnutrition in India is not only of alarming magnitude, but also of great intricacy. Tackling malnutrition in urban slums requires a holistic approach, especially when targeting population of infant and young children.

Studies and statistics suggest that there were studies conducted in big cities and metropolitan cities like Mumbai, Kolkata, Pune etc., and no studies in the present study area so investigator felt to conduct a study to assess the nutritional status of preschool children living in urban slum areas in Karad.

**Aims**

- To assess the Nutritional Status of preschool children (3-5 Years) attending anganwadi in selected urban slum areas of Karad.
- To find the association between nutritional status and demographic variables of preschool children.

**Materials and Method**

Karad lies at the confluence of Koyna River and the Krishna River called Sangam. 11% of the population in Karad is comprised of children below 6 years of age. Migrated people from other cities in Maharashtra and neighboring state comprises the population of Karad and mainly engaged in casual semiskilled and unskilled labour work. Karad is having six urban slum areas and housing conditions in these slums are very poor and they are provided with common tap water and sanitary blocks, by the Nagarpalika. Low standard of living and unhygienic conditions are clearly evident while visiting anganwadis in these areas for the data collection purpose of this study.

A community-based cross-sectional study was conducted in urban slum areas of Karad, Maharashtra, during 2017-18. Permission to conduct the study was obtained from the institutional ethical committee of the KIMSDU, Karad, ICDS Satara and informed consent was obtained from the parents at the time of data collection.

Sample size includes 137 preschool children.

Sampling criteria: Preschool children living in the selected urban slum area of Karad were included and children who were not resident of the slum but attending anganwadi and children above 5 years were excluded from the study.

Demographic data of children were collected from mothers by interview by using pre-tested structured demographic performa and the nutritional status of children was assessed by weight measurement digital weighing machine with minimum clothing. The data was analysed by descriptive and inferential statistics.

**Interpretation of Nutritional Status:** Nutritional status was categorized according to IAP classification based on weight for age. IAP designates a weight of more than 80% of that expected for age as normal. Grades of malnutrition are:

- Grade I - 71-80
- Grade II - 61-70
- Grade III - 51-60
- Grade IV - ≤ 50%
Results

Description of Demographic Characteristics of Preschool Children: Distribution of demographic variable of children shows that according to birth order, out of 137 preschool children majority of 51 (37.2%) children were of first birth order, 65 (47.4%) were in the age group of 49-54 months, 79 (57.7%) were girls and 74 (54%) had birth weight of 2.5 Kg - 3 Kg.

Assessment of nutritional status of preschool children

Section A: Assessment of nutritional status according to weight for age by IAP classification

Table 1: Assessment of nutritional status according to weight for age by IAP classification

<table>
<thead>
<tr>
<th>Grade</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>83</td>
<td>60.58</td>
</tr>
<tr>
<td>1st Grade</td>
<td>43</td>
<td>31.39</td>
</tr>
<tr>
<td>2nd Grade</td>
<td>11</td>
<td>8.03</td>
</tr>
</tbody>
</table>

Table 1 shows the distribution of nutritional status of preschool children according to IAP classification that 60.58 % of children were normal, 31.39% of children were suffering from Grade I malnutrition and 8.03% of children were suffering from Grade II malnutrition and none of them were suffering from Grade III and IV malnutrition.

Table 2: Age-wise distribution of preschool children according to IAP classification of nutritional status

<table>
<thead>
<tr>
<th>Age (in months)</th>
<th>Normal</th>
<th>1st Grade</th>
<th>2nd Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>37-42</td>
<td>27</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(19.8%)</td>
<td>(10.9%)</td>
<td>(0.7%)</td>
</tr>
<tr>
<td>43-48</td>
<td>14</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(10.2%)</td>
<td>(7.4%)</td>
<td>(3.6%)</td>
</tr>
<tr>
<td>49-54</td>
<td>42</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(30.7%)</td>
<td>(13.1%)</td>
<td>(3.6%)</td>
</tr>
</tbody>
</table>

Table 2 outlines the age-wise distribution of nutritional status of preschool children according to IAP classification, in the age group of 37-42 month 19.8% were normal, 10.9% were suffering from Grade I malnutrition, 0.7% were suffering from Grade II malnutrition. In those aged 43-48 months 10.2% were normal, 7.4% were suffering from grade I malnutrition and 3.6% were suffering from Grade II malnutrition. In the age group of 49-54 months, 30.7% of children were normal, 13.1% of children were suffering from Grade I malnutrition and 3.6% were suffering from Grade II malnutrition.

Table 3: Gender wise distribution of preschool children according to IAP classification of nutritional status by sex of the child

<table>
<thead>
<tr>
<th>Grade</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>41</td>
<td>42</td>
</tr>
<tr>
<td>1st Grade</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>2nd Grade</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 3 shows the gender wise distribution of nutritional status of preschool children according to IAP classification 29% of boys were normal, 10.21% and 2.1% were suffering from Grade I and Grade II malnutrition, respectively; 30.6% of girls were normal, 21.1% and 5.8% were suffering from Grade I and Grade II malnutrition, respectively.

Association between nutritional status of preschool children and demographic variables according to IAP classification of nutritional status: Association between nutritional status of preschool children and demographic variables according to IAP classification of nutritional status by chi-square test shows that there was no significant association between nutritional status of preschool children with their demographic variables.

Discussion

Preschool child constitute the most vulnerable segment of any community. Their nutritional status is a sensitive indicator of community health and nutrition. Under-nutrition among them is one of the greatest public health problems in the developing countries. About 128 million (70%) of the world’s 182 million stunted children aged under five years live in Asia.

According to NFHS-4 (2015-16), 35.7 per cent children below five years are underweight, 38.4 per cent are stunted and 21 per cent are wasted in the country. NFHS-3 shows that 42.5% of underfive children were underweight, 19.8% were wasted and 48% werestunted. India accounts for more than 3 out of every 10 stunted children in the world. More than one third of the world’s children who are wasted live in India.
A similar study conducted by Raje V et al shows that 57.41% were normal, 33.33% were suffering from Grade I malnutrition and 7.41% of children were suffering from Grade II malnutrition and 1.85% were suffering from Grade III and none of them were suffering from Grade IV malnutrition.14

Areppalli S et al reported that 34.5% children were suffering from grade I malnutrition followed by grade 2 (33.1%), grade 3 malnutrition (6.1%) and grade 4 malnutrition (1.5%).15 Other studies which shows similar results are Narkhede V et al reported that 32.18% children were in grade I, 16.09% in grade II, 3.46% in grade III and 0.5% in grade IV malnutrition.16 Damor RD et al reports that 54% of children were suffered from malnutrition and in which half of them belonged to grade-I and grade-II17. Sandeep B et al reported that 12.4% and 28.5% children were belonged to grade IV and III, 36.9% and 22.3% of children belonged to grade I and II malnutrition.18

Results of the study conducted by Goel et al shows that 57.4% children were malnourished. Out of which Grade I 107(19.8%), Grade II 137(25.4%), Grade III 45 (8.3%) & Grade IV 21 (3.9%).19

Kapil et al reported in their study in Delhi revealed that overall prevalence of PEM was found to be 81.8%, while 19.11%, 41.4%, 5.7% and 0.2% of children had grades Normal, Grade I, Grade II, Grade III, and Grade IV PEM respectively.20

Age-wise distribution of nutritional status of preschool children according to IAP classification shows that in the age group of 37-42 month 10.9% were suffering from Grade I malnutrition. In those aged 43-48 months 7.2% were suffering from grade I malnutrition. In the age group of 49-54 months 13.1% of children were suffering from Grade I malnutrition.

Sukla P, Borkar A states that this may be due to as child grows, moves outside and subjected to environment he is more prone for acquiring infectious disease21. A similar study conducted by Sahoo DP et al shows acute malnutrition in 3–5 years age group (43.6%).22

Gender wise distribution shows that 12.31% boys and 26.9% of girls were suffering from various grades of malnutrition.

Sandeep B et al reported in their study that malnutrition was more prevalent in female children 54.6%.18 Luthra M et al shows in Anganwadi center A undernutrition was higher among girls (69.5%) than boys(60%). In Anganwadi center B girls (49.5%) were slightly less undernourished than boys (52.7%).23 Gondikar A et al in their study found that malnutrition rate was high in female children i.e 29.3% than that in male children 24.8%24. Sahoo DP et al reports Acute malnutrition was almost similar in females 64 (50.4%) and males 72 (50.3%). 22

Concludingly

High prevalence of undernutrition of among 3-5 years was found in urban slums of Karad highly suggests that there is a strong need for educating the mothers about factors affecting nutritional status of preschool children. Mothers should get adequate information regarding the nutritional needs of the growing children and importance of complete immunization to protect the children from vaccine preventable diseases. Most emphasis should be given during health education of antenatal and post natal mothers regarding importance of exclusive breastfeeding, timely weaning with foods easily available in the local market, that too at low cost, providing proper protein rich, energy dense complementary food. Nutritional education should be considered as major intervention to reduce problem of Malnutrition. Anganwadi workers, local mahila mandals, community based organizations and volunteer groups can help organize regular meetings of these mothers in order to address the issues regarding proper child rearing practices.

Ethical Clearance: Taken from Institutional Ethics Committee of the Krishna Institute of Medical Sciences Deemed to be University, Karad.

Source of Funding: Self.

Conflict of Interest: Nil

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Prevalence and Associated Risk Factors of Postnatal Depression in South Asian Region—A Systematic Review

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ABSTRACT

Background: Postnatal depression is an important complication of child-bearing and can have long-term adverse consequences for both mother and child.

Objective: To estimate the prevalence and identify the associated factors of postnatal depression in South Asian region.

Method: Observational cohorts and surveys were searched in Medline, Cinhal, ProQuest, and Scopus databases from 2005 to 2016. Original articles published in English language were included in the study.

Results: of 324 articles, 28 studies (15,345 samples) were eligible for analysis. The overall prevalence rate of depression during postnatal period was 26% (0.21, 0.30 CI). Risk factors for postnatal depression were grouped under following categories: demographic, psychological, social, obstetric and infant.

Conclusion: Health care professionals should screen the women for possible risk factors and depressive symptoms during perinatal period so that suitable interventions can be initiated if required in a timely fashion.

Keywords: Systematic review, prevalence, risk factors, postnatal depression, South Asia.

Introduction

Postnatal depression (PND) affects 10-15% of women worldwide after childbirth (¹). It is an important public health concern, taking place during pregnancy and postnatal period in which a great change and transition take place in women (²).

Severe postpartum depression can lead to infanticide as well as maternal death, often by suicide (³). Early recognition of depressive symptoms, treatment and counseling of women can prevent potentially serious consequences of PND (⁴).

A literature review on associated risk factors for postnatal depression among women in Asian cultures reported prevalence of PND ranged from 3.5% (Malaysia) to 63.3% (Pakistan) (⁵). Various studies from India have also reported significant rates of postnatal depression. 23% (⁶), 6% (⁷), and 11.3% respectively (⁸).

Risk factors of postnatal depression have been consistently demonstrated by various research studies. Prenatal depression or anxiety, recent stressful life events, low social support, past history of depression, poor self-esteem, maternal anxiety, complications during prenatal period and delivery, single mother, poor partner relationship, lower socioeconomic status including income, delivering a female baby when male is desired, infant born with congenital deformity, relationship
difficulties with in-laws and parents, and recent adverse life events during prenatal period were the risk factors of PND (6-11).

A few studies regarding prevalence and associated risk factors for postnatal depression have been conducted in developing countries. The current review aimed at summarizing and synthesizing the prevalence of postnatal depression based on self-reported questionnaire and clinical interview and the associated risk factors of postnatal depression in South Asian countries.

**Method**

A comprehensive literature search was performed using following electronic databases: PubMed, Cinhal, ProQuest, and Scopus databases. Additional articles were searched from Google scholar. The key words used were “prevalence”, “epidemiology”, “depression”, “postnatal”, “postpartum”, “perinatal”, “maternal”, “after childbirth”, risk factors, “associated factors”, “predictors”, and “South Asia”.

**Inclusion Criteria:** The criteria mentioned below are used as pre-requisite for the selection of studies:

Original research articles in the form of observational cohorts, surveys, or database analysis were included. Studies that have observed and identified associated risk factors for postnatal depression in South Asian countries and published in English peer-reviewed journals between 2005 and 2016 were selected.

**Results**

A total of 324 studies were identified in the literature search for potential inclusion. After evaluating the title and abstracts, 83 studies were selected for detailed assessment. Of these, twenty eight articles were excluded because of duplications (using the information from the same studied sample), twelve studies were conducted on Indians residing other than south Asian region, four were reviews, and two were letters/editorials. Thirty seven articles were assessed for quality, and nine articles were excluded for not meeting the criteria. Finally twenty-eight studies were deemed as eligible for analysis. The studies included 15,345 samples. Most of the study subjects were recruited from outpatient departments of hospitals attached with medical colleges (n=10), two studies recruited women from well-baby clinic/immunization center (n=2), a few studies selected participants from district hospitals/maternity and child health centers (n=4) followed by community based settings both rural and urban (n=10).

Two studies did not mention the recruitment setting (n=2). There was also a wide variation in the criteria used for diagnosing postnatal depression among the investigators across the countries.

**Prevalence of Postnatal Depression:** In this review, the magnitude of postnatal depression in South Asian countries ranged from 4.9% to 57% with the lowest reported in Nepal and the highest in the Pakistan (shown in figure 1). In our study countries, pooled prevalence rates of postpartum depression 26% (0.21, 0.30 CI) was higher than in high-income countries. The studies from India reported the prevalence rate of 48.5 (6), 12.5% (11), 26.3% (14), 25% (17), 15.8% (18), 16% (19), 31.4% (22), 18% (24), and 7.5% (30) of PND respectively. A prevalence rate of 33.1% (16), 35.5% (20), 1% (23), 38.3% (25), 23% (31), 48.4% (32), and 29.6% (35) respectively was reported from Pakistan. One study from Bangladesh reported 22% (26) of prevalence of postnatal depression. The prevalence of PND in Nepal ranged from 4.9% (27) to 30.3% (23). There is a wide range in the outcome assessment of postnatal depression with regard to its timing and it occurred anytime from day one of postnatal period till one year. Three studies assessed women on more than one time, i.e. 11.3%, 15.8%, and 15.5% at 2-3 days, 6 weeks and 12 weeks postnatal respectively (8), 94% at 3 months, 76% at 6 months, and 62% at 12 months postpartum (12), and 26.7% at one month, 11.9% at 3 months, 2.6% at 6 months after delivery (13).

![Figure 1: Prevalence of postnatal depression in south Asian countries](image-url)
Risk-factors associated with postpartum depression:
Number of risk factors were identified on analyzing the selected studies. These risk factors were grouped under following categories:

**Demographic factors:** The demographic risk factors associated with PND are maternal age less than 20 or over 30 years, lower education, illiteracy of the husband, housing type, type of family, husband’s occupation, and low family income.

**Psychological factors:** Among these, the factors which have shown significant association with PND are history of past mental illness, stressful recent life events, lower self-esteem, feeling tense during pregnancy, low mood/mood swings during pregnancy, addiction and violence by the husband, antenatal depression, unhappy marriage/marital dissatisfaction, history of depression, and physical abuse during current pregnancy and after childbirth, family history of depression-psychiatric illness, past history of psychiatric illness and history of abuse, those who have unpleasant relationship with their in-laws, mental stress, smoking and drinking during pregnancy, and history of domestic abuse.

**Socio-cultural factors:** Regarding socio-cultural factors, low socio-economic status/poverty, poor social support, women who could not confide in partner, overcrowding, poor marital relationship, poor relationship with mother-in-law, disappointment with the sex/gender of the baby, having never had a son, maternal age less than 20 or over 30 years, lower education, illiteracy of the husband, type of family, housing type, type of family, and low family income are associated with PND.

**Obstetric factors:** The obstetric factors that were found to be associated with postnatal depression are unwanted or unplanned pregnancy, past history of miscarriage, complications in pregnancy/know medical illness, poor obstetric outcome, caesarean section, single mother, multigravida/multiparity, intrapartum complications, perinatal health problems, and poor or no antenatal care.

**Infant factors:** Birth of female child, infants born with congenital malformation, infant health and infant birth weight are associated with postnatal depression.

**Discussion**

Current review estimates the prevalence of postnatal depression in south Asian region from 4.9% (Nepal) to 57% (Pakistan) which supports the findings of a review on perinatal depression reported 20% of prevalence of depression during pregnancy and 21.8% of depression during postnatal period respectively. A wide range of prevalence of PND was reported from 40 countries in 143 studies and it ranged from 0–60%.

The review also determined several risk factors of postnatal depression from south Asian countries. Most factors seem to be similar to other studies conducted in western and Asian countries such as demographic factors (e.g., age, literacy level, type of housing), psychological (e.g., antenatal depression, past history of psychiatric illness, addiction in husband), social (socio-economic status, lack of support from husband and in-laws, domestic violence), obstetric (unplanned/unwanted pregnancy, complications during pregnancy/medical illness) and infant (e.g., birth of a female child/dissatisfaction with sex of the baby, low birth weight, congenital malformations). Overall, the data in this study indicate that postpartum depression in women living in South Asian countries is caused by multiple factors.

**Conclusion**

Based on the results achieved from the current research on the relatively high postpartum depression, it is recommended that required arrangements are made for taking care of postnatal women’s mental health. The important need of health care professionals to play a role in reducing the depressive symptoms and bringing up healthy children in the society is highlighted in the study.

**Conflict of Interest:** Nil.

**Source of Funding:** Self.

**Ethical Clearance:** Not applicable.

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Impact of Quality of Work Life Dimensions on Level of Profitability: A Study on Jute Industry in Andhra Pradesh and West Bengal, India

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ABSTRACT

This study creates and tests hypotheses to analyse empirically how the perceived picture of a company’s quality of work life will affect its market and financial performances. Quality of work life has turned into a critical angle in the present focused on life. Indeed it has turned into a trendy expression today for every one of the associations with regards to keeping up representative’s employment fulfillment levels high. Presently it has been utilized as strategic approach to get, draw and safeguard the human ability. QWL related rules currently turning into the components of the association approaches. Development and productivity of two gatherings of freely held organizations were looked at dependent on deals development, resource development, return on value, and profit for resources. Findings from this empirical study suggest that companies with high quality of work life can also enjoy exceptional growth and turnover and profitability.

Keywords: Quality of work life, profitability, Employees, Growth, jute industry, India

Introduction

The Quality of Work Life of an organization can be evaluated by opinions of employees on statements regarding quality of work life [QWL] aspects. Quality of work life is the quality of relationship among employees and total work environment, concern for the impact of work on individuals as well as on organizational effectiveness furthermore, the possibility of interest in authoritative critical thinking and basic leadership. The accomplishment of every organization is highly dependent on the utilization of organizational goals. To accomplish organizational goal, individual goals have to be satisfied, in that Quality of work- life directly contributes to the utilization, development and achievement of organization and human resource goals. The study was based on the factors affecting Quality of work- life and the relationships between QWL and satisfaction of the employees in the jute industries. A study of these factors is of extraordinary importance since a direct relationship between quality of work life and motivation, and motivation and productivity is known to exist (Danna and Griffin, 1999). Further, an inside and out perception of these components can likewise help in decreasing the regularly raising dimensions of contention and in this manner wearing down in the working environment (Li and Yeo, 1979). It is the responsibility of the management to facilitate a work environment, which conductive to good performance. To avoid such possibility from arising, the management should provide a good working environment where employees can work without stress, where necessary information for accomplishing task is made available adequate and fair compensation is given in the work place is safe, healthy and the supervisors motivates the employees.

Review of Literature

Nanjundeswaraswamy & Swamy (2013)¹ in the study “Quality of Worklife of Employees in Private Technical Institutions” examine that Male employees are more satisfied than female employees the chi square test decided that all the demographical factors like gender, designation, salary, department, experience are independent of quality of work life of employees in private technical institution. Study also tells that there is important association among QWL of Teaching and Non-teaching staffs. S.Subhashini, C.S. Ramani Gopal (2013)² in the study “Quality Of Work Life Among Women Employees Working In Garment Factories In
Coimbatore District” focused about Women workers of the organization are most satisfied with the Work atmosphere and job security measures of the factory and are not much satisfied about the permitted leave that would be availed. The study also shows that increase in quality of work life results in increase in productivity. Jerome. S,” (2014)⁴, A Study on Quality of Work Life of Employees at Jepiaiar Cement Private Ltd: Perambalur” in the study found that the quality of work life contributes to the workers’ performance in a holistic manner. The study also helps to reveal the loop holes of the Company in providing the workers’ basic needs and to know how the workers are treated by the management. M. Aarthy & Dr. M. Nandhini, (2016)⁵, “A Study on Quality of Work Life Among The Engineering College Faculty Members In Coimbatore District” the study reveals that there is a moderate level of Quality of Work Life is found among the faculty members and the demographic variables namely age, gender, marital status, income, experience and number of children has an important influence on the Quality of work life of the engineering college faculty members. Shweta Pandey & M. S Khan (2016)⁶ “A study of quality of work life and its impact on Performance appraisal” in their study high quality of work life is essential for organizations to continue to attract and retain employees. This is one of the reason QWL concept has gained momentum recently and researches are going on worldwide to find out inputs for framing effective QWL strategies. Moreover this tells and supports the relationship between QWL, employee performance and career growth aspects which leads to performance appraisal. Still many facets of QWL need to be unexplored through further studies. M Aarthy, & Dr. M Nandhini (2016)⁶, “Influence of the Demographic Factors on Quality of Work Life of the Engineering College Faculty Members in Coimbatore District “in their study The impact of the Quality of Work Life of the faculty members is highly notable and it influences not only the institutions but also the students who are the future building blocks of the nation. This study tells that there is a moderate level of Quality of Work Life is found among the faculty members.

Level of Profitability: Lau and May (2007)⁷ examined empirically how the perceived image of a company’s Quality of Work Life will affect its market and financial performances. The study stated that companies with high Quality of Work Life can also enjoy unusual growth and profitability. Heskett J.L et al. (1997)⁸ demonstrated that QWL which is sustained by the feelings that employees have toward their jobs, colleagues, and companies would excite a chain result leading to an organization growth and profitability in the end. To better the QWL of the employees companies are now highlight on warm employee relations and adopting a human resource policy that place high value on employees as organization stakeholders. K. Nithyavathi and N. Shani (2010)⁹, explained on Quality of Work Life of employees in textile industry and found that Quality of Work Life has six factors that give meaning to work: the purpose of work, its moral correctness, and autonomy, pleasure at work, recognition and positive relationships. When employees recognize these features in their job, they tend to experience psychological wellbeing and effective commitment to the organization.

Research Problem: From the review of literature found that, a job is compatible with an employee when it involves duties and assignments that the employee finds interesting. There is a need to address the level of profitability to improving the quality of work life dimensions of employees.

Objective of the Study: The main objective of the study is to study the impact of quality of work life dimension on level of profitability in Jute Industry.

Hypothesis of the Study

H1: Quality of work life dimensions influences level of profitability in jute industry.

Research Methodology

![Fig. 1: Research flow chart of the study](image-url)
Data Analysis

Table 1: Table showing the responses of the respondents on “work friendly environment in the organisation”

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>6</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Low</td>
<td>61</td>
<td>11.3</td>
<td>11.3</td>
<td>12.4</td>
</tr>
<tr>
<td>Neither Low nor High</td>
<td>187</td>
<td>34.6</td>
<td>34.6</td>
<td>47</td>
</tr>
<tr>
<td>High</td>
<td>200</td>
<td>37</td>
<td>37</td>
<td>83.9</td>
</tr>
<tr>
<td>Very High</td>
<td>87</td>
<td>16.1</td>
<td>16.1</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>541</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The above table displays that, out of 541 employees 1.1 percent opined the work friendly environment is very low, 11.3 percent opined the work friendly environment is low, 34.6 percent opined the work friendly environment is neither low nor high, 37.0 percent opined the work friendly environment is high, 16.1 percent opined the work friendly environment is very high. Majority of the respondents (53.1 percent) opined that, the work friendly environment in their organisation is high and very high. So, it is concluded that, jute industry created work friendly environment to its employees.

Table 2: Table presenting the responses of the respondents on “harmonious relationship in the organisation”

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>9</td>
<td>1.7</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Low</td>
<td>43</td>
<td>7.9</td>
<td>7.9</td>
<td>9.6</td>
</tr>
<tr>
<td>Neither Low nor High</td>
<td>114</td>
<td>21.1</td>
<td>21.1</td>
<td>30.7</td>
</tr>
<tr>
<td>High</td>
<td>284</td>
<td>52.5</td>
<td>52.5</td>
<td>83.2</td>
</tr>
<tr>
<td>Very High</td>
<td>91</td>
<td>16.8</td>
<td>16.8</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>541</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The above table shows that, out of 541 employees, 1.7 percent opined the harmonious relationship is very low, 7.9 percent opined the harmonious relationship is low, 21.1 percent opined the harmonious relationship is neither low nor high, 52.5 percent opined the harmonious relationship is high, 16.8 percent opined the harmonious relationship is very high. Majority of the respondents (69.3 percent) opined that, the harmonious relationship in their organisation is high and very high. So, it is concluded that, jute industry build harmonious relationship among the employees.

Table 3: Table showing the responses of the respondents on “training and development in the organisation”

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>7</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Low</td>
<td>78</td>
<td>14.4</td>
<td>14.4</td>
<td>15.7</td>
</tr>
<tr>
<td>Neither Low nor High</td>
<td>132</td>
<td>24.4</td>
<td>24.4</td>
<td>40.1</td>
</tr>
<tr>
<td>High</td>
<td>244</td>
<td>45.1</td>
<td>45.1</td>
<td>85.2</td>
</tr>
<tr>
<td>Very High</td>
<td>80</td>
<td>14.8</td>
<td>14.8</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>541</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The above table shows that, out of 541 employees, 1.3 percent opined the training and development is very low, 14.4 percent opined the training and development is low, 24.4 percent opined the training and development is neither low nor high, 45.1 percent opined the training and development is high, 14.8 percent opined the training and development is very high. Majority of the respondents (59.9 percent) opined that, the training and development in their organisation is high and very high. So, it is concluded that, jute industry provided training and development to its employees.
Table 4: Table showing the responses of the respondents on “compensation and rewards in the organisation”

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>8</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Low</td>
<td>42</td>
<td>7.8</td>
<td>7.8</td>
<td>9.2</td>
</tr>
<tr>
<td>Neither Low nor High</td>
<td>180</td>
<td>33.3</td>
<td>33.3</td>
<td>42.5</td>
</tr>
<tr>
<td>High</td>
<td>233</td>
<td>43.1</td>
<td>43.1</td>
<td>85.6</td>
</tr>
<tr>
<td>Very High</td>
<td>78</td>
<td>14.4</td>
<td>14.4</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>541</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The above table shows that, out of 541 employees, 1.5 percent opined the compensation and rewards is very low, 7.8 percent opined the compensation and rewards is low, 33.3 percent opined the compensation and rewards is neither low nor high, 43.1 percent opined the compensation and rewards is high, 14.4 percent opined the compensation and rewards is very high. Majority of the respondents (57.5 percent) opined that, the compensation and rewards in their organisation is high and very high. So, it is concluded that, jute industry provided compensation and rewards to its employees.

Responses of the respondents on “job security in the organisation”: It shows that, out of 541 employees, 1.5 percent opined the job security is very low, 7.9 percent opined the job security is low, 23.3 percent opined the job security is neither low nor high, 48.4 percent opined the job security is high, 18.9 percent opined the job security is very high. Majority of the respondents (67.3 percent) opined that, the job security in their organisation is high and very high. So, it is concluded that, jute industry provided job security to its employees.

Regression Analysis

Showing multiple regressions between quality work life and level of profitability

H1: Quality of work life dimensions influences level of profitability in Jute Industry

Model summary table showing the result of multiple regressions between quality work life and level of profitability:

Table 5: Table showing multiple regressions between quality work life and level of profitability

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R square</th>
<th>Adjusted R square</th>
<th>Std. error of the estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.696</td>
<td>0.484</td>
<td>0.478</td>
<td>0.58886</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), psychological factors, harmonious relationship, job security, grievances, compensation and rewards, work friendly environment, training and development

b. Dependent variable: level of profitability

R. This shows the correlation coefficient. The value 0.696 which shows strong positive relationship between the predictors and dependent variable.

R squared. This is $r^2$, the coefficient of determination. The value of R square tells how many points fall on the regression line. 0.484 of the difference of y-values around the mean are described by the x-values. In other words, 0.484 of the values fit the model.

Adjusted R square. The modified $R$-square adjusts for the number of terms in a model. The value of modified R square is 0.478

Standard Error of the regression: An estimate of the standard deviation of the error $\mu$. The standard error of the regression is the precision that the regression coefficient is measured i.e.; 0.58886.

It shows that, the independent variables are having significant impact on dependent factor of level of
profitability i.e., R² is 48 percent, thus, the quality of work life dimensions influence level of profitability in Jute Industry.

Table 6: Table showing ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>173.573</td>
<td>7</td>
<td>24.796</td>
<td>71.51</td>
<td>.000b</td>
</tr>
<tr>
<td>Residual</td>
<td>184.818</td>
<td>533</td>
<td>0.347</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>358.392</td>
<td>540</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. **Dependent Variable**: level of profitability

b. **Predictors**: (Constant), psychological factors, harmonious relationship, job security, grievances, compensation and rewards, work friendly environment, training and development

The F-ratio in the ANOVA table, tests whether the general regression model is a good fit for the data. The table shows that the independent variables statistically significantly predict the dependent variable, F (7, 533) = 71.51, P < 0.05

The regression model is a good fit of the data and accepted.

So, the hypothesis “Quality of work life dimensions influences level of profitability in jute industry” can be accepted.

**Conclusion**

Quality work life (QWL) is seen as a contrasting option to the control approach of overseeing employees. The QWL approach considers employees as “asset” to the association instead of as “costs”. Level of profitability shows positive consequences of QWL. As per analysis it concluded that that the improvement of the quality of work life on all aspects will result in the level of profitability gives the best end results for the organization.

**Ethical Clearance**: Questionnaire

**Source of Funding**: Self

**Conflict of Interest**: Nil

**REFERENCES**


Assessment of Sports, Yoga with Mind Training and Sports, Yoga Training on Students with Cigarette Addiction

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Abstract

For the purpose of the study 75 students who were, addicted to smoking cigarettes were selected from Theni district, Tamil Nadu, India as subjects. The subjects were divided in to three groups in which group-1 was (Sports, Yoga with mind training-S.Y.M group) with 25 subjects, and group -2 was Sports and Yoga training-S.Y group)with 25 subjects, Group- 3 was control group- C.G) with 25 subjects, Group -1 S.Y.M underwent Sports activities, Yogic practice with mental training and group -2- S.Y underwent sports activities and yogic practice and group-3 C.G group did not participate in any of the training programme, and the training programme was scheduled for Five days a week S.Y.M group were made to play various games, practice yoga and mind training and S.Y group Played Games and practiced Yoga for a period of 10 months before and after the end of the training data was collected from the subjects of all the three groups. The collected data from the three groups were statistically analysed by using two-way ANOVA. To find out significant difference for the paired mean difference Scheffe’s test used whenever required. S.Y.M group and S.Y showed significant change in overcoming from smoking addiction, But S.Y.M Group was remarkable better than other groups.

Keywords: Rehabilitation, Cigarette addicted students, sports, yoga, and mind training

Introduction

Drug addiction or substance abuse has been a social menace universally. Owing to various reasons the occurrence of drug addiction related problems cannot eradicated completely by any country. But, as a responsible society every community, nations or administration cannot turn its face on this social evil. Cigarette smoking obsession has been a social menace world-wide. Owing to various reasons the occurrence of drug addiction related problems cannot be done away totally by any country. But, “as a answerable society every community particularly teaching community, nations or administration cannot turn its face on this social evil” (Jagatheesan Alagesan 2013) working out at a gym, or taking a brisk walk, physical activity triggers brain chemicals that make you feel happier and more relaxed. Team sports provide a chance to unwind and engage in a satisfying challenge that improves your fitness. They also provide social benefits by allowing to connect with teammates and friends in a recreational setting. mind is distracted from daily stressors” (Lawlor and Hopker 2). This can help to avoid getting bogged down by negative thoughts. Sports reduces the levels of stress hormones in body. At the same time, it stimulates production of endorphins. These are natural mood lifters that can keep stress and depression at bay. Endorphins may even leave feeling more relaxed and optimistic after a hard workout. Experts agree to determine the relationship between sports and depression. (Dodoz, and Beatly 1999) 3 Said that It’s common for an individual to become anxious or depressed when dealing with withdrawal, but sports can foster healthy, addiction-free living. ‘Yoga is a powerful and beautiful way for and ease way through recovery and gain the peace of mind need to beat addiction’. (Kochupillai 2005) 4 “A rhythmic yoga breathing (Sundarshan Kriya Yoga) decreased use of tobacco in twentyone percent of individuals after six months of practice”. Tobacco smoking is one of the
leading preventable cause of death. Mind training are structured psychological or social interventions used to address substance related problems. Mind training practiced at different stages of drug treatment to identify the problem, treat it, and assist with social reintegration. Psychosocial interventions used to treat many different types of drug problems and behavioral addictions. Motivational interviewing is a collaborative conversation style for strengthening a person’s own motivation and commitment to change. (Miller and Rollnick, 2013) 

Mind training is used to help people with different types of drug problems. Frequently, individuals are not fully aware of their drug problems or they can be ambivalent about their problems. Motivational interviewing is often referred to as a conversation about change and it is used to help assist drug users to identify their need for change. It seeks to address an individual’s ambivalence about their drug problems, as this is considered the main barrier to change. It follows five stages: (1) expressing empathy for the client; (2) helping the client to identify discrepancies between their behaviour and their goals; (3) avoiding arguments with the subjects about their motivations and behaviours; (4) rolling with the resistance of the subject to talk about some issues; and (5) supporting the subject’s sense of self-efficacy.

Methodology

The purpose of the study was to analyze the effects of sports, yoga, and mind training as a combined form of training on rehabilitation of cigarette smoking students. For this purpose, seventy-five male students with the age group of 19-21 were selected at random as subjects from Tamil Nadu, India. In which group-1 S.Y.M group with 25 and Group-2 S.Y. Group with 25 subjects represented as experimental groups in which S.Y.M group underwent sports, yoga, and mind training and group-2 S.Y underwent sports activities and yoga training and group-3-C.G group acted as control group which did not participate in any of the training. Test for nicotine was conducted before training period for both experimental groups and control group. The training programme was scheduled for 5 days a week for 45-60 minutes, they were made to play various games, practice of yoga and mind training was given for a period of 10 months. After ten months of training re-test for level of nicotine was taken. And the data collected were analyzed by Analysis of variance (ANOVA) was used and, further, since three groups were involved, whenever the ‘F’ ratio was significant, Scheff’e S post hoc test was used to determine which of the paired mean differ significantly.

In all cases, the 0.05 level of confidence fixed to test the level of significance which considered as an appropriate. Test for nicotine conducted before training period for S.Y.M, S.Y group and C.G group before and after training period C.G group did not under go any training.

Test Procedure: Test for nicotine level in subjects (NCE-M03-8B) *This test gives an indication of the tobacco consumption level of subjects. It detects in the urine the presence of cotinine, which is the main biomarker of smoking. Any consumption of cigarette will produce traces of cotinine in the body, and this is what this test screens.

After ten months of training test for level of nicotine was taken. And the data collected were analyzed by Analysis of variance (ANOVA) was used for computing, further, since two groups were involved, whenever the ‘F’ ratio was significant, Scheff’e S post hoc test was used to determine which of the paired mean differ significantly.

Result of Study

The pre and post test data collected from the experimental and control groups were statistically analysed by ANOVA and the results are presented in table 1

| Table 1: Analysis of Variance on Experimental and Control Groups |
|---|---|---|---|---|---|---|---|
| Means | Group-I SYM | Group-II SY | Group-III. C.G | SV | SS | df | MS | Obtained ‘F’ |
| Pretest mean | 2.86 | 2.86 | 2.93 | B | 0.04 | 2 | 0.02 | 0.21 |
| Posttest mean | 1.13 | 1.46 | 2.80 | B | 23.33 | 2 | 11.66 | 62.28 |
| Adjusted posttest means | 1.13 | 1.47 | 2.79 | B | 22.66 | 2 | 11.33 | 60.80 |

*Significant at 0.05 level
The required table value for significance at 0.05 level of confidence with degrees of freedom 2 and 42 is 3.23 and degree of freedom 2 and 41 is 3.23

*Significant at .05 level of confidence.

Table-1 shows that the pre-test mean of S.Y.M. group, S.Y groups and control group are 2.86, 2.86 and 2.93 respectively. The obtained ‘F’ ratio value of 0.21 for pre-test means of S.Y.M group, S.Y. group and C.G group were less than the required table value of 3.23 for the degrees of freedom 2 and 42 at 0.05 level of confidence. It reveals that there is statistically insignificant difference among the three groups during pre-test period. It inferred that the random assignment of the subjects for the three groups is successful.

The post-test mean value for post-test of S.Y.M. group, S.Y groups and control group are 1.13, 1.46 and 2.80 respectively. The obtained ‘F’ ratio value of 62.28 for post-test means of S.Y.M group, S.Y. group and C.G group were higher than the required table value of 3.23 for the degrees of freedom 2 and 41 at 0.05 level of confidence. So, there was a significant difference occurred due to training.

The adjusted post-test means of S.Y.M. group, S.Y groups and control group are 1.13, 1.47 and 2.79 respectively. The obtained ‘F’ ratio value of 60.80 for adjusted post-test means of S.Y.M group, S.Y. group and C.G group were higher than the required table value of 3.23 for the degrees of freedom 2 and 41 at 0.05 level of confidence. It is observed from this finding that significant differences exist among the adjusted post-test means of both experimental groups and control group.

Since, the adjusted post-test ‘F’ ratio value is found to be significant the Scheffe’s test is applied to find the paired mean differences, and it is presented in table-2

Table 2: Scheffe’s Test for the Difference between the Adjusted Post Test Paired Means of Spiking Ability

<table>
<thead>
<tr>
<th>Adjusted Post Test Means</th>
<th>S.Y.M. GROUP</th>
<th>S.Y. GROUP</th>
<th>C.G. GROUP</th>
<th>DM</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.33</td>
<td>2.79</td>
<td>1.46</td>
<td>0.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.33</td>
<td>1.47</td>
<td>0.14</td>
<td>0.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.47</td>
<td>2.79</td>
<td>1.32</td>
<td>0.45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant

The result of Table - 2 shows that there are significant differences between the adjusted post-tests means of S.Y.M. group and C.G. groups; S.Y.M group and S.Y group; S.Y group and C.G group on addiction on smoking. Both S.Y.M and S.Y group had impact on reducing cigarette smoking on students, but S.Y.M group (sports, yoga, mind training group) showed high impact on rehabilitation from cigarette addiction.

Discussions

This study was deliberate attempt to experiment sports, yoga, and mind training for effective rehabilitation of drug addicts. The study was offered with the idea that when worldwide trends in rehabilitation program of drug addiction primarily emphasis on regaining health and fitness status through structured sports program. Yoga therapy is a traditional Indian medicine which includes actives like sports. The efficacy of sports based rehabilitation program is not well understood or not accepted in the context of practices and so the effect of yoga.

Hence taking up a research work on drug rehabilitation with yoga concurrently with a regular stereo typed program of an established center did fill up a need of the time

This study was deliberate attempt to experiment sports, yoga, and mind training for effective rehabilitation of drug addicts. The study was offered with the idea that when worldwide trends in rehabilitation program of drug addiction primarily emphasis on regaining health and fitness status through structured sports program.

The results presented in Table -1 proved that GROUP-1 has reduced 1.13 due to SYM training and similarly SY group reduced to 1.47. The mean difference was further subjected to ANOVA and obtained F values were significant at 0.05 level. The post hoc analysis and paired mean comparisons results presented in Table 2 shows that compared to control group SYM and SY cigarette addiction groups significantly reduced cigarette smoking. But SYM group showed better reduction in smoking cigarette than SY group.

Table 2: Scheffe’s Test for the Difference between the Adjusted Post Test Paired Means of Spiking Ability

<table>
<thead>
<tr>
<th>Adjusted Post Test Means</th>
<th>S.Y.M. GROUP</th>
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<td>2.79</td>
<td>1.32</td>
<td>0.45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*significant
Parks GA., et al. (2011)\(^7\) investigated the effect of yogic practices (Vipassana Meditation) and mental training on Alcohol, smoking and Drug Relapse and Criminal Recidivism. After regular yogic meditation and psychological mind training reduce alcohol, smoking and other drug use subjects started to overcome addiction. (American addiction centre)\(^8\) says that “in addition to,” and not “in place of.” Yoga is often beneficial when used with sports and mind training is a best treatment to overcome drug addiction. Marlatt GA et.al. \(^9\) Investigated, The Effects of Vipassana Meditation and Other Rehabilitation Programs on Alcohol and Drug Relapse and Criminal Recidivism, finding of his investigation proves that that yoga therapy program is effective in the rehabilitation of drug addicts. Dongshi Wang\(^10\) Investigated on impact of Physical Sports on Substance Use Disorders, the outcome of the study was that sports activities will reduce the depression symptom and reduce the use alcohol and nicotine. Mark A. Smith., et al(2011)\(^11\) in his investigation stated “ability of sports to serve as an alternative, non-drug reinforcer” (Roessler 2010.)\(^12\) Research revealed physical sports improved the quality of life of drug users. The result of the research showed that patients’ quality of life improved quality of life and they had high level of energy. The result revealed that physical sports can be used as support in drug abuse treatment. (Bentley, R., 2007)\(^13\) findings of the study proved that Behaviour and psychological therapies are the treatments for persons with addictions. By giving reinforcement every time for an addictive behaviour. The effect on the central nervous system could be a positive reinforcement.\(^10,13,14\) The findings of this study reveals SYM and SY would effectively rehabilitate cigarette habit when psychological training is combined with sports and yogic training the result was much better, So it is confirmed that S.Y.M. training is one of the best training for drug rehabilitation.

**Conclusion**

It was concluded that when (S.Y.M) Sports, Yoga and Mind training is combined and practiced by Cigarette addiction men, it can rehabilitate them from cigarette addiction.

**Ethical Clearance:** Taken from D.R.C. Committee, Annamalai University, Department of Physical Education and Sports Sciences, Chidambaram-608002.

**Figure 1:** Showing the Mean Value Experimental and Control Groups

**Source of Funding:** Nil.

**Conflict of Interest:** Nil.

**REFERENCE**


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Hepatoprotective Effect of Nigella Sativa Seed Extract against Isoniazid and Rifampicin Induced Hepatotoxicity

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ABSTRACT

Background: Current century with advanced medical care still holds Tuberculosis as a prevalent condition around the world. The context to default is the adverse effects faced by patients taking anti-tubercular drugs. The most perilous among the adverse effect is hepatotoxicity and can be ameliorated by the effect of Nigella Sativa seeds.

Objectives: To study the hepatoprotective role of Nigella Sativa seed extract against Isoniazid and Rifampicin induced hepatotoxicity.

Materials & Method: The animals were divided into three groups with six animals in each group. Group I served as normal control, Group II served as positive control and received Isoniazid and Rifampicin for 10 days. Group III received Isoniazid and Rifampicin with Nigella Sativa seed extract 900mg/kg was given for 10 days. Blood samples were sent for AST, ALP, ALT analysis and the liver tissue for histopathology studies.

Results: Table 2 showed decrease in AST, ALP, and ALT values in group III when compared with group II. Histopathology showed reduced hepatotoxic changes in group III when compared with group II.

Conclusion: The hepatoprotective property of Nigella Sativa seed extract will be a new path for safer and effective Tubercular therapy in developed and developing countries.

Keywords: Tuberculosis, Nigella Sativa seed, Isoniazid, Rifampicin, Hepatoprotective

Introduction

Tuberculosis holds its stand as one of the challengeable morbidity in the world. Being 100% preventable and 100% curable1 it still remains as a contest for the medical community to eradicate it. The most effective cure for Tuberculosis in the current medical practice is the first line of Anti-tubercular drugs2. Isoniazid, Rifampicin and Pyrazinamide are the common hepatotoxic agents in DOTS regimen (Directly observed Short Course Therapy by World Health Organization). Isoniazid and Pyrazinamide are directly acting hepatotoxins, whereas Rifampicin is enzyme inducer promoting the up regulation of hepatic cytochrome P450 enzyme (CYP2D6 and CYP3A4), thus indirectly promotes the hepatotoxicity of Isoniazid3,4.

Isoniazid and Rifampicin causes oxidative activation of Cytochrome P450 mono-oxygenase system which leads to generation of electrophilic intermediate and free radicals resulting in liver injury in animal models5,6. Nigella Sativa belongs to Ranunculaceae family and found commonly around Asian, Middle

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Eastern, Mediterranean and African countries\(^2\). History of *Nigella sativa* begins as early as second millennium BCE, Archeological evidences proves their presence from ancient Egypt-Tutankhamun’s\(^8\) and was also obtained from Hittite flask in Turkey\(^9\). Nigella Sativa seed is used in treatment of fever, Viral flu, Scorpion sting, Asthma, headache, Rheumatoid arthritis, Warts and Snake bites\(^10,11,12,13,14\).

*Nigella Sativa* seed possess special properties like anti-inflammation\(^1,5,16\), anti-oxidant\(^17,18,19\), anti-cancer\(^20,21\), immune stimulant and anti-microbial action\(^22\). These credentials have made *Nigella Sativa* seed extract to be effective against hepatitis, hepatotoxicity’s, hepatic carcinomas. The current study targets Nigella Sativa seed extract effect against Isoniazid and Rifampicin induced hepatotoxicity. Thus ant-tubercular regimen can be followed with utmost efficacy and safety.

Materials and Method

Isoniazid was purchased from Pfizer Pvt Ltd and Rifampicin from Cyper Pharma Ltd. Isoniazid 50mg/kg was dissolved in distilled water to form 1ml/kg and Rifampicin 100mg/kg was dissolved to obtain 1ml/kg and the Ph was adjusted to 3 with 0.1N Hcl to form clear solution\(^23\).

*Nigella Sativa* Seed Extract: *Nigella Sativa* was purchased from local vendor in Chennai and authenticated by Botanical survey of India, Southern regional center, Tamil Nadu agricultural University, Tamil Nadu. The *Nigella Sativa* seeds were washed with water then air dried, and homogenized to form fine powder. It was then stored at 40°C in airtight container. The *Nigella Sativa* powder 250gms was extracted with 2500ml of aqueous ethanol for 48hrs. The extract was filtered using whatman filter paper. The formed residue was extracted twice with same fresh solvent. The filtrate was concentrated using a rotary vacuum evaporator at low temperature (30° - 40°C) and pressure. The final brown material obtained was suspended in water prior to treatment.

Experimental Designs: Eighteen wistar albino rats weighing 130-150 gms were used in the study. The study was approved by Institutional Animal Ethical Committee. Animals were housed at a temperature of 24 ± 2°C and relative humidity of 30-70%. The animals were fed with staple pellet diet from Hindustan Lever Ltd., Mumbai. The animals were divided into three groups with six animals in each group. Group I served as normal control and received water, pellet diet ad libitum. Group II served as positive control and received Isoniazid 50mg/kg orally and Rifampicin 100mg/kg orally for 10days. Group III received Isoniazid 50mg/kg orally with Rifampicin 100mg/kg and *Nigella Sativa* seed extract 900mg/kg was given for 10days. On the eleventh day the blood samples were collected before animal sacrifice. The liver tissues were isolated and send for Histopathological studies\(^25\). Estimation of AST,ALT was done using Reitman method\(^26\) and ALP was done using Bessey method\(^27\).

Statistical Analysis: Data was collected and analyzed using IBM statistical package for social science (SPSS) software version 21. The data’s were presented in mean ± standard deviation and “t” test was used for statistical significance.

RESULTS

Current study showed that Isoniazid and Rifampicin showed escalation of liver function test. Table 1 shows the changes in body weight of animals. Group II showed a decrease in body weight when compared with normal group I. Group III had minimal reduction in body weight when compared with group II.

Table 2 shows the liver function test with mean and standard deviation values. The ALT values where significantly P<0.001 increased in Group II when compared to Group I. In group III the ALT values are reduce significantly P<0.0001 when compared with group Group II. The ALT and AST values are significantly reduced P<0.0001 in Group III when compared with Group II. The histopathological report of Group I section study showed normal histology of liver with central vein in the middle of lobule and cords of unremarkable hepatocytes extending towards the periphery. In Group II the section studied showed hepatic parenchyma with centrilobular hemorrhage and severe ballooning degeneration of the hepatocytes. Sinusoidal congestion, marked steatosis and dense lymphocytic infiltration are seen. Group III section showed mild congestion of central vein, marked reduction in the lymphocyte infiltrate in hepatic parenchyma and mild steatosis seen at the periportal hepatocytes. Few apoptotic hepatocytes are also seen.
Table 1: Mean value ± SD of Body Weight of Rats in experimental rat groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Weight in Gms at 0 days</th>
<th>Weight in Gms at 11th days</th>
<th>Difference in the weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>215.50 ± 9.09</td>
<td>211.66 ± 10.63</td>
<td>3.83 ± 2.13*</td>
</tr>
<tr>
<td>Group II</td>
<td>211.33 ± 4.41</td>
<td>200.16 ± 3.54</td>
<td>11.16 ± 2.48</td>
</tr>
<tr>
<td>Group III</td>
<td>213 ± 6.22</td>
<td>204 ± 5.65</td>
<td>9.00 ± 3.52**</td>
</tr>
</tbody>
</table>

Difference in body weight: *P<0.05 compared with group III (treatment group); **P<0.005 compared with group II (control positive group)

Table 2: Mean value ± SD of Liver Function Test in experimental rat groups

<table>
<thead>
<tr>
<th>Group</th>
<th>ALT(U/L)</th>
<th>AST(U/L)</th>
<th>ALP(IU/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>25.76 ± 2.98</td>
<td>55.55 ± 2.47</td>
<td>94.80 ± 2.44</td>
</tr>
<tr>
<td>Group II</td>
<td>46.96 ± 1.94</td>
<td>87.75 ± 3.52</td>
<td>144.21 ± 3.65</td>
</tr>
<tr>
<td>Group III</td>
<td>30.83 ± 1.77</td>
<td>67.75 ± 2.68</td>
<td>114.48 ± 6.13</td>
</tr>
</tbody>
</table>

Figure 1: Nigella Sativa: Hepatoprotective Mechanism

Discussion

Drug induced liver injury is commonly excluded clinical diagnosis. Around 30% of fulminant liver failure and 2% of jaundice in hospitals are due to drug induced toxicities\textsuperscript{28,29}. The major limitations for the use of anti-tubercular drugs are the adverse effects. Isoniazid and Rifampicin induced hepatotoxicity is used as an experimental model to study drug induced hepatoxicity\textsuperscript{30,31}. The two basic mechanism behind Rifampicin induced hepatotoxicity (1) Competeting with bilirubin at sinusoidal membrane for clearance in a dose dependent manner\textsuperscript{28,32} and (2) inhibiting bile salt exporter pumps\textsuperscript{33}. Isoniazid is metabolized to form a reactive metabolite which reduces the level of free radical scavengers like glutathione related thiols, glutathione peroxidase and catalase activities\textsuperscript{34,35}. When combined Rifampicin induces the toxicity of Isoniazid\textsuperscript{36}.

\textit{Nigella Sativa} seeds are traditionally used in and around Asian region as anti-emetic\textsuperscript{37,38}, anti-septic\textsuperscript{39}, indigestion, dysmenorrhea and anti-tussive\textsuperscript{40}. In the current study \textit{Nigella Sativa} seed extract has reduced AST, ALP and ALT. \textit{Nigella Sativa} seed extract acts as a hepatoprotective agent by inhibiting iron dependent lipid peroxidation in concentration dependent manner\textsuperscript{41} and also possess oxygen scavenging activity\textsuperscript{42,43,44}. Study by Founda AMM et al has \textit{Nigella Sativa} seed extract contains Thymoquinone which inhibits the activity of cytochrome 1A1 and cytochrome 1A2 isoenzyme of
hepatic system. These enzymes are majorly involved in biotransformation of many Xenobiotic substances. Study by Awad A et al showed that Thymoquinone an active ingredient of Nigella Sativa seed reduced the Isoniazid and Rifampicin induced cytochrome3A1 mRNA expression of Spermine N-1-acetyl- Transferase which is a catabolic enzyme that involves polyamine alteration in liver tissues.

Study by Yesmin.F et al showed that Nigella Sativa seed extract protects hepatocyte from injury by its antioxidant and anti-inflammatory properties. Daba MH et al showed that ratio of helper to suppressor Tcells, natural killer cell and production of Interleukin-3 were increased by the stimulatory effect of Nigella Sativa seed ingredients on macrophages. Study by Yesmin et al showed the hepatoprotective role of Nigella Sativa against NSAID induced hepatotoxicity. In the study Nigella Sativa seed extract showed antioxidant and anti-inflammatory property.

Image 1 shows the hepatoprotective mechanism of Nigella Sativa seed extract. Similar effects are pronounced in the current study where Nigella Sativa seed extract has shown a protective effect against Isoniazid and Rifampicin induced hepatotoxicity. In the future Nigella Sativa ingredients can be isolated and specifically used along with anti-tubercular regimen to reduce hepatotoxicity. The hepatoprotective property of Nigella Sativa seed extract will be a new path for safer and effective therapy in developed and developing countries.

Conclusion

Treatment with anti-tubercular drugs can be made innocuous by the use of Nigella Sativa seed extract. Its hepatoprotective effect alleviates the hepatotoxicity of first line anti-tubercular drugs and reduces the defaulters in anti-tubercular treatment. Combing Nigella Sativa seed extract with DOTS regimen can be a novel path for safer treatment in Tuberculosis.

Conflict of Interest: Nil

Acknowledgement: Nil

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Artificial Intelligence as a Tool to Enhance HIV-AIDS Programme Management

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ABSTRACT

The HIV prevalence in South Africa is the highest in the world. In 2017, 12.6% of the population, 7.06 million people were HIV positive. Almost two thirds of this cohort are on ARVS contributing to South Africa’s ARV programme-making it the largest in the world. Other sectors within the health industry have also contributed to addressing the burden of disease by developing their own sector specific HIV-AIDS programmes. Over time, these programmes have grown from strength to strength and have incorporated components to driver better performance within these programmes. A novel concept in health technology is that of artificial intelligence (AI) and machine learning, which is redefining the health industry and is fast becoming very popular locally and globally. AI has not been fully integrated into the HIV-AIDS field to date. This paper explores the artificial intelligence landscape in the HIV-AIDS arena and assesses if AI can enhance HIV-AIDS programme management.

Keywords: HIV-AIDS, artificial intelligence, machine learning

Introduction

Artificial intelligence (AI): “is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans”. Machine learning is another core part of AI. Learning without any kind of supervision requires an ability to identify patterns in streams of inputs, whereas learning with adequate supervision involves classification and numerical regressions. AI is has been revolutionising the landscape of technological advancements with its impact being felt across all sectors. A novel area of interest is the interplay of AI across the health sector. AI together with machine learning is being introduced across the various disciplines of health. to date AI has been used to predict treatment outcomes for ill patients, to generate treatment plans for common illnesses and to assess common signs and symptoms to prompt individuals to seek care. The association of AI on the HIV-AIDS health sector is a new one but a very intriguing one as the benefits of enhancing HIV-AIDS care are many. HIV-AIDS still remains a significant disease burden across South Africa and across the world. There are an estimated 7.1 million people living with HIV in 2017. 86% know their status, 65% on treatment and 81 are suppressed. Adherence to ARVS is also a critical component of HIV-AIDS programmes as robust programmes are based on clinically sound patients who are adherent to medication. On adherence often results in resistance and other opportunistic infections which often contribute to mortality and morbidity.

Methodology

Desktop research was undertaken given the relatively new nature of the integration of AI with HIV-AIDS. Available literature was reviewed with relevance to HIV-AIDS and AI. Secondary data was reviewed to assess existing pre-published information. The aim was to assess main needs and gaps locally and abroad in order to develop further research ideas in order to continue to enhance the current field of research. A data review was done to critically analyse which HIV-AIDS programmes embodied AI techniques with machine learning. As this is a relatively new concept, it was not envisioned that many programmes will exhibit this functionality given the scarcity of resources and the cost to implement.

Results

The analysis revealed that extraordinary work was being done with AI and HIV-AIDS. This included new
app development, prediction of clinical codes, predicting disease monitoring trends, pathology monitoring and potential drug patterns monitoring. To date, however no model exists to predict growth of programmes and management thereof. This revealed a void in this arena creating a need for further research and development.

Conclusion

The benefits of AI include a predictable preemptive clinical decision making system which can aid patients and healthcare workers alike. Having a suitably constructed and appropriately managed AI system will allow all programme managers and healthcare workers to identify high risk members based on relevant eligibility criteria. This will then allow programme managers the ability to suitably deploy resources where they are most required to ensure that high risk members receive more clinical interventions than low risk. AI through machine learning, can allow HIV-AIDS programmes to triage their patrons into high, medium and low risk. This will concentrate more efforts on members who need more attention, therefore resulting in a more cost effective management approach. In order to ensure no lost to follow up, AI will be able to generate patient profiles which will allow staff to track and trace members, resulting in a more cooperative cohort to be followed up in care. Learning and development can also occur from trend analysis of data generated in order to capacitate healthcare workers.

Adherence and compliance are key outputs of HIV-AIDS programmes as these translate directly into outcomes of the programme and its patients. Implementing a properly design AI system with consistent maintenance, will allow for enhancing and optimizing patient care in HIV-AIDS programmes. This can be rolled out locally and adapted globally and can be sensitized for private, public and ngo sectoral HIV-AIDS programmes.

Competing Interests: NIL

Source of Funding: Durban University of Technology as part of the primary author’s doctoral thesis.

Ethical Clearance: Durban University of Technology as part of the primary author’s doctoral thesis.

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A Review of the South African Anti-retroviral Treatment Programme

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ABSTRACT

South Africa has almost 3.4 million people on treatment, more than any other country in the world. Scale up of antiretroviral therapy globally and locally has surpassed expectations. Global coverage of antiretroviral therapy reached 46% at the end of 2015. In September 2015, The World Health Organisation called for international guideline changes introducing the concept of “Test and Treat”. Based on significant research trends and experimental evidence, this new approach which encourages universal testing and treating of all HIV positive individuals is set to be the net game changer in the field of HIV-AIDS. However the practical implications of operationalizing this, may pose challenging for most countries especially South Africa where the current ARV patients are set to double. This article reviews the ARV programme and explores its strengths, weaknesses, opportunities and threats amidst the many challenges that plague this country and sets the path for recommendations and best practises toward future successes.

Keywords: HIV-AIDS, Test and Treat, World Health Organisation, Ant-retro-viral

Introduction

Sub-Saharan Africa is the region worst-affected by HIV and AIDS. South Africa has the highest prevalence of HIV/AIDS compared to any other country in the world and this is a prominent health concern, with 5, 6 million people living with HIV, and 270,000 HIV related deaths recorded in 2011. The South African ARV programme is now internationally recognised as successful despite a slow start, and is responsible for recent dramatic improvements in South African life expectancy. The South African ARV Programme is based on the clinical goals to reduce the HIV viral load to undetectable levels and to enhance quality of life with reduction in opportunistic infections.

The next section provides a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis of the South African ARV programme in order to identify strengths and weaknesses towards harnessing best practises.

Strengths

Guidelines: HIV-AIDS is a dynamic field in that the protocols and procedures governing clinical management are changing daily based on novel and innovative approaches emanating from local and global research. The World Health Organisation has led the clinical field with proactive clinical guidelines guiding clinical discretion among policy makers, clinicians and healthcare workers. These guidelines are based on evidence based teachings and learning’s based on data collection form research in both the developed and developing countries. Most countries echo the WHO guidelines as the source and key reference for clinical decision making in most countries. South Africa also utilises the clinical guidelines from the South African HIV clinicians’ society. This society has been formed by experienced and seasoned clinicians governing the clinical aspects of the disease in South Africa and other developing countries. These guidelines provide clinical information from both the private, public and parastatal sectors and hence provide a rich source of clinical information for treating clinicians to make informed decisions. The South African Department of health also provides a Clinical Guideline for the management of HIV-AIDS in adults and children which is often revised and/or updated annually. As such there is a wealth of information informing clinical governance over HIV-AIDS in the South African context.

The South African ARV programme—the largest global ARV programme
The South African ART programme is the largest ART programme in the world. Boasting over 7 million individuals on ART, the programme has unique abilities to learn and guide future ARV developments and clinical management. Due to its size and its expansive nature given the geographic location of the programme, this ART programme has the potential to leverage greater skills, learning curves and opportunities for the developed and developing world alike.

**Generic Medication:** The pharmaceutical industry has boomed with the advent of ARV therapy and its generics in the African and South African markets. Generics are cheaper versions of the originator products which are more widely available and more affordable and accessible. ARV generics have boomed in the South African market with more cost effective drugs being delivered to ARV programmes in the state sector. The South African Department of health also conducts the procurement of ARVS through their national tender process which is extended to all ARV producers nationally and internationally. Given the competitive nature of the tender, highly sought after ARVS are procured through very competitive pricing making healthcare easy, acceptable and affordable. As the South African ARV programme procures most of the ARVS globally, the ARVS are available at cheaply negotiated pricing.

**Weaknesses**

**Drug Shortages:** As the South African ARV programme is the largest in the world, it often faces drug stock outs and shortages. This occurs often as a result of poor forecasting and planning in the drug procurement and distribution process. What has been noticed is the poor implemention of good pharmaceutical practices which does not enable adequate drug utilisation.

**Staff shortages:** The brain drain is a considerable healthcare concern in South Africa. This is the loss of several healthcare workers to due to other disciplines and other industries and many to other countries. This is purely due to poor working conditions, poor infection control and high patient volumes. This further creates a bigger burden on the work loads and on the mandates of the clinics to meet patient and client needs. Given that South Africa has the largest ARV programme in the world; it subsequently requires a significant clinical and non-clinical task force in order to provide daily service delivery.

**Opportunities**

**Integration of care:** Integrated care creates a better healthcare experience for you. Integration decreases the cost of healthcare delivery. Integration promotes better health outcomes. Holistic patient care is now the future of healthcare. Integrated care is the concept where a patient is holistically managed through all aspects of disease progression. This helps to manage patients thoroughly with no gaps and deficiencies thus working toward cost effective care and efficient patient models of care. The implementation of integrated TB/HIV electronic data collection and clinic management tools has the potential to galvanise TB/HIV integration at primary care level.

**Public private partnerships:** A great deal of potential exists for collaboration between public and private institutions to leverage partnerships. There can be opportunities to drive down medication costs to ensure profitable partnering. Pharmaceutical companies play a pivotal role in the ARV healthcare sector. These partnerships can prove beneficial.

**Differentiated models of care:** Current models of delivering ART care in resource limited settings are being stretched to the limit. With 37 million people worldwide living with HIV and recommended for treatment, innovative solutions are urgently needed to provide quality, life-saving HIV care. The differentiated care framework includes specific care packages based on care needs. As national HIV guidelines evolve to start all people living with HIV on antiretroviral therapy (ART), delivery of care will need to adapt to the increase in the number of people and their diverse needs.

**Funding:** Local and global sustainable means of funding will always be a contentious issue with the rising costs of inflation burdening the world economy. The ARV drug regimens are possibly some of the most costly medications which need to be taken daily as lifelong therapy. With competitive pharmaceutical markets, competitive prices together with the generic boom in the industry, ARV pricing has become more affordable but not yet cost effective. The South African department of health also procures their drugs for the programme through the national treasury process of tendering and as such the largest ARV pharmaceutical companies are invited to tender to allow for drug procurement.
**Adherence:** Adherence and compliance to chronic medication remains the main barrier to ART success. Having to take medication daily to prevent costly life threatening consequences is a tall order and is a challenge not only for the HIV-AIDS disease management sector but for all other therapeutic areas. The consequences for HIV-AIDS can result in HIV resistance, noncompliance, changing drug regimens and greater risk of acquisition of opportunistic infections. One of the greatest challenges of the ART programme both in the private and public sectors is to ensure that patients maintain and sustain their drug utilisation. Stronger support structures and teams are required for targeted counselling approaches to encourage better compliance on the programme.

**Recommendations**

**Adopt an electronic register:** The only way to ensure that there is adequate resource allocation to cover the necessary population coverage is if this area of HIV-AIDS service delivery becomes registered electronically. If patients are tagged with unique identifiers such as ID or another number then it would be possible to accurately estimate patient and treatment numbers and then allocate patients and nurses accordingly.

**Monitoring and evaluation:** Many different countries and institutions have contributed to the current understanding of how best to monitor and evaluate HIV-AIDS programmes. Monitoring and evaluation of HIV-AIDS programmes commenced in early 2000 and was developed as result of consultation with programme staff, donor representatives and evaluation specialists from institutions all over the world. This complex field has grown since then and will continue to grow to match the disease trends of the epidemic.

**Conclusion**

The South African ARV programme has many lessons to share with the world. The experience learnt through early adopters and first mover advantages together with challenges past, present and on-going continue to be learning curves for the country and the world to learn from. Best practices per category of care e.g. drug supply, pharmacy, clinical should be developed to enhance and improve approaches to care. The ARV programme is the largest and is set to double in size. The South African ARV programme can only grow from strength to strength if supported by tools, frameworks and approaches toward holistic integrated care.

**Competing Interests:** NIL.

**Source of Funding:** Durban University of Technology as part of the primary author’s doctoral thesis.

**Ethical Clearance:** Durban University of Technology as part of the primary author’s doctoral thesis.

**REFERENCES**


The Integrity and Team Commitment Influences Analysis Toward Patient Safety Incident Reporting (PSIR) at Inpatient Installation of the Sidoarjo District Public Hospital, East Java, Indonesia

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ABSTRACT

In order to improve the quality of care delivered to the patients, Sidoarjo District Public Hospital as one of Public Hospital at The East Java Province, Indonesia has implemented Patient safety standard, however patient safety incidents reported at Hospital Patient Safety Team, as one of the indicators in patient safety, from 2013 to 2016 was only 31.83% which was still bellowing the Standardizing Medication Error Event Reporting in the U.S. Department of Defense (DOD) i.e. 40.3%. Patient safety is a system that provides patient the care needed in order to preventing injury as a result of the error on doing treatment as well as the error on not doing treatment for a patient at a hospital.

This analytic observational quantitative research employed by a cross sectional design. Data collected from all teams (33 teams) which consist of 7 – 9 members worked on the inpatient installation of the Sidoarjo District Public Hospital from March to June 2016 using questionnaire.

The aims of this research were to describe the integrity and team commitment toward PSIR and analysis the influence of integrity and team commitment to PSIR on the inpatient installation of the Sidoarjo District Public Hospital.

Results from this research shows that there were significant effects of integrity and team commitment toward Patient Safety Incident Reporting at the inpatient installation of the Sidoarjo District Public Hospital with significant influence 0.002 and 0.000, consecutively. Hence, in order to increase patient safety incident reporting on the inpatient installation of the Sidoarjo District Public Hospital, it is important to be taken into account the activities that can be used to increase the integrity and team commitment.

Keywords: Reporting, Patient Safety, Integrity, Team Commitment

Introduction

Patient Safety is a system that provides patient the care needed in order to preventing injury as a result of the error on doing treatment as well as the error on not doing treatment that actually needed for a patient at a hospital. Patient safety consist of several activities which are the risk assessment, the identification and management of patient risk, the patient safety incident reporting (PSIR) and the incident analysis, the lesson learning capability from the previous incident and the follow up, the solution implementation in order to minimize risk of the treatment in the future (¹). The patient safety focuses in increasing the quality of care in a hospital driven by the high number of adverse event at a hospital (²). Implementing patient safety in a hospital is much more important than the services efficiency (³).

The activities done in patient safety not an easy and simple activity, it is a continuing process that based on lesson learned from a patient safety incident on the past and then arrange preventive strategy to avoid the
repeated incident happened in the future, in the same unit or in the other unit at a hospital. The most important knowledge in the field of patient safety is how to prevent harm to patients during treatment and care\(^{(4)}\).

The PSIR as one of activities of the patient safety program, actually the core one, can provide information about the causes root of patient safety incident that can be used to prevent repeated incidents in the future. It is a mechanism to detect and surveil patient safety and also an entry point process for patient safety lesson learned in order to prevent the same incident to be happened in the future\(^{(5)}\).

The PSIR is every unintentional and unattended event that causes or potentially causes an injury for patient at a hospital \(^{(1)}\). The PSIR consist of Adverse Event, Near Miss Event, Not Cause Injury Event, Potentially Injury Event and Sentinel Event. The Adverse Event is defined as an incident or event that caused patient injury. The Near Miss Event is an incident or event that almost caused patient injury. The Not Cause Injury Event is an incident or event that not caused a patient injury. The Potentially Injury Event is a condition that potentially can cause injury and The Sentinel Event is an incident or event that caused mortality or serious injury.

The fundamental role of the PSIR is to enhance patient safety by learning from previous patient safety incident and increase the quality of health care\(^{(4)}\). The disobedience in PSIR is a failure in overcoming the incident happened.

In Indonesia the report of PSIR still very low and even if there is a report collected, the calculation of event related to patient safety still very limited\(^{(6)}\). Based on data recorded at Hospital Patient Safety Team of The Sidoarjo District Public Hospital, PSIR from 2012 – 2015 was only 31,83\(\%\), which was still bellowing the Standardizing Medication Error Event Reporting in the U.S. Department of Defense (DOD) i.e. 40.3\(\%\). According to Patient Safety Committe of The Sidoarjo District Public Hospital patient safety incident still often happened but not fully reported.

However, implementing the PSIR requires every employee in the organization to care of a patient’s potential risk that only can be done if every employee at The Sidoarjo District Public Hospital has a high integrity and team commitment toward PSIR.

Integrity, defined by Andrian Gostik & Dana Telford as a consistency between values and deeds. Building a high integrity is a continuing and never ended process \(^{(7)}\). Whereas, employee commitment to his/her organization defined by Allen, N, J., & Meyer JP as a psychology state that characterized by the believe and acceptance of the goal and values of the organization, the readiness to work hard for the organization, and the high desire in remaining as a member of the organization\(^{(8)}\).

The aims of this research were to describe the integrity and team commitment toward PSIR and analysis the influence of integrity and team commitment to PSIR on the inpatient installation of the Sidoarjo District Public Hospital.

**Method**

This analytic observational quantitative research employed by a cross sectional design. The analysis unit is all team (33 teams) worked on inpatient installation of The Sidoarjo District Public Hospital. Data collected from March to June 2016 using rating scale questionnaire.

The independent variables were integrity and team commitment, whereas dependent variable is PSIR.

Data analysis using the univariable analysis to describe the distribution of frequency and proportion of independent and dependent variables and also a linear regression analysis to analyze the influence of independent variables toward the dependent variable.

**Result**

(a) Descriptive statistic: The result of this research shows that PSIR on inpatient installation average was high i.e. 84.8\(\%\). The complete description of PSIR on Inpatient Installation of The Sidoarjo District Public Hospital is shown in table 1.

<table>
<thead>
<tr>
<th>PSIR</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>5</td>
<td>15.2</td>
</tr>
<tr>
<td>High</td>
<td>28</td>
<td>84.8</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The description of team integrity toward PSIR on inpatient installation of The Sidoarjo District Public Hospital average also High i.e. 75.8\(\%\). The complete description of integrity toward PSIR is shown in table 2.
Table 2: Integrity in Inpatient Installation of The Sidoarjo District Public Hospital

<table>
<thead>
<tr>
<th>Integrity</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>4</td>
<td>12.1</td>
</tr>
<tr>
<td>Medium</td>
<td>4</td>
<td>12.1</td>
</tr>
<tr>
<td>High</td>
<td>25</td>
<td>75.8</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The description of team commitment toward PSIR on inpatient installation in The Sidoarjo District Public Hospital average was also high i.e. 51.5%. The complete description is result shown in table 3.

Table 3: Team Commitment in Inpatient Installation of The Sidoarjo District Public Hospital

<table>
<thead>
<tr>
<th>Team Commitment</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Medium</td>
<td>15</td>
<td>45.5</td>
</tr>
<tr>
<td>High</td>
<td>17</td>
<td>51.5</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100.0</td>
</tr>
</tbody>
</table>

(b) Linear Regression Analysis: The result of linear regression analysis shows that there were significant influences of integrity and team commitment toward PSIR with p 0.002 and 0.000, consecutively. The complete result of linear regression analysis is shown in table 4.

Table 4: Influence of Integrity and Team Commitment toward PSIR

<table>
<thead>
<tr>
<th>Linear Regression Analysis</th>
<th>B</th>
<th>b</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrity</td>
<td>0.239</td>
<td>0.520</td>
<td>0.002</td>
</tr>
<tr>
<td>Team Commitment</td>
<td>0.827</td>
<td>0.763</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Discussion

Result from this research shows that integrity and team commitment toward PSIR in the inpatient installation of The Sidoarjo District Public Hospital are high meaning that most of the team at Inpatient installation already have a high integrity and a high team commitment in doing PSIR. Furthermore, from linear regression analysis shows that integrity and team commitment have a significant influence toward PSIR at the inpatient installation of The Sidoarjo District Public Hospital that was proven by the high category of PSIR at amount 84.4%.

Unfortunately, this data different from the data recorded on Hospital Patient Safety Team, which is only 31.83%. This fact indicated that the PSIR on the inpatient installation of The Sidoarjo District Public Hospital only recorded at intern installation, but failures to be reported to the Hospital Patient Safety Team of The Sidoarjo District Public Hospital.

The reason for this different data maybe because the report was tucked away in other reports so it is not received by the Hospital Patient Safety Team or other human errors that usually happened to the routine busy activities at a hospital, both by the health functional workforces at the inpatient installation and also by the Hospital Patient Safety Team of The Sidoarjo District Public Hospital themselves.

It was also caused by the grading mechanism in PSIR flowchart scheme at The Sidoarjo District Public Hospital that are consist of blue grade, green grade, yellow grade and red grade. Only the yellow and red grade will be reported to the Hospital Patient Safety Team and continue with the root cause analysis by the team while the blue and green grade only follow by simple investigation by the head of the installation.

Other than that, all the report is still a paper based report that also makes many room for human error.

To overcome this problem, it is important to build a system for avoiding the mis reported of the PSIR and limited any other human mistakes that can ended by the increasing patient safety incident. The system can be integrated with the hospital management information system.

It is also important to pointed special officers responsible for patient safety because the officer that becomes the member of the Hospital Patient Safety Team of The Sidoarjo District Public Hospital are also having a main responsibility as a health’s functional workforce. Because of that, in order to consistently and focusly handling patient safety program as their adding responsibility, then they have to prolong their working hour, even though based on research by A.E. Rogers et all the risks of making an error were significantly increased when work shifts were longer than twelve hours, when nurses worked overtime, or when they worked more than forty hours per week.(9) or in other word we can say that overtime work increase the risk in making error.
Other than that, it is also important to re-arrange the PSIR flow chart scheme so every event must be reported to the Hospital Patient Safety team.

Increasing the number of the supervision by the hospital management in order to give motivation and also support to the health’s functional workforce at the The Sidoarjo District Public Hospital also can be implemented. Managerial support as one of work environment has significant effect in improving health care at the hospital\(^{(10)}\), including the PSIR as the main activity on patient safety program. Managerial supervision also important to maintain the same perception about the importance of PSIR and offer the solution for the PSIR problem at every unit of the The Sidoarjo District Public Hospital.

Regulate the PSIR as an obligatory task of health’s professional worked at The Sidoarjo District Public Hospital especially at inpatient installation and giving reward and punishment mechanism to support this regulation. As state by Sari ABA et al that the voluntary reporting systems may under-report incidents, owing to lack of feedback; time constraints; fear of shame, blame, litigation, or professional censure; and unsatisfactory processes\(^{(11)}\).

**Conclusion**

Based on this research, the implementation on PSIR at the inpatient installation of The Sidoarjo District Public Hospital is run well because the employee worked in this installation already have a high integrity and team commitment. From the linear regression analysis also found that the integrity and team commitment have a significant influence toward PSIR. The problem is that the data from inpatient installation of The Sidoarjo District Public Hospital was different from data collected at The Hospital Patient Safety Team of The Sidoarjo District Public Hospital.

These differences cause by the PSIR flowchart scheme itself and also by other human errors, both the human errors done by the health’s functional workforces, worked on inpatient installation and also by the officer as a member of The Hospital Patient Safety Team.

To resolve this problem, it is important to make a paperless report by utilizing hospital management information system. It is also important to re-arrange the PSIR flowchart scheme so every grade of the patient safety event will be reported to Hospital Patient Safety Team. Pointing special officers responsible as the member of The Hospital Patient Safety Team, optimizing the supervision by hospital management and regulate PSIR as an obligatory task also a recommended activity that can be done in order to increase the PSIR and improve the health care delivered at the The Sidoarjo District Public Hospital.

**Conflict of Interest:** There is no conflict of interest for both authors.

**Source of Funding:** This research, funded by the authors themselves. No other financial support received.

**Ethical Clearance:** All procedures performed in studies involving human participants had gotten ethical approval from the Health Research Ethics Committee, Faculty of Public Health Airlangga University Number 201-KEPK signed on April 30\(^{th}\) 2015.

**Informed Consent:** Informed consent was obtained from all individual participants included in the study.

**REFERENCES**


Effect of Using Different Healthy Lighting Sources on Some Productive and Physiological Characteristics of Japanese Quail

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ABSTRACT

Background and Objective: Artificial lighting is as an important management tool to regulate production and welfare. The study was conducted in the poultry farm of Agriculture College - University of Tikrit. This study was designated to investigate the effect of different light sources on some productive and physiological characteristics of Japanese quail.

Methodology: A total of 180 day old quails used in this study. Quails were divided in three treatments LED, Compact Fluorescent (CFL) and incandescent (INCAN) by 60 birds per treatment, and each treatment is divided into six replications of 10 birds. The duration of this study was 7 weeks.

Results: The study found no significant differences in body weight, body weight gain, feed conversion ratio and carcass yield, for all groups during the total period of the experiment. There was a significant increase in the weight of relativity spleen for CFL and INCAN compared to the LED at the age of 7 weeks. As for the female reproductive system, the CFL treatment showed a significant increase in ovarian weight compared to the INCAN treatment, while the LED treatment did not differ significantly from the other treatments. At the age of 7 weeks, the CFL showed significant increase in the number of mature ovarian follicles compared with the INCAN treatment, while the LED treatment did not differ significantly from the other treatments.

Conclusion: It is possible to use the LED lighting system to minimize energy expenses in quail housing.

Keywords: Quail, LED, fluorescent, lamp, incandescent, performance

Introduction

The birds have highly developed visual systems and most of their behaviors are mediated by their vision1. The change in human lifestyle in many countries and the economic development leads to search for rich sources of nutrients, including poultry products of meat and eggs. Poultry products is an important source of animal protein, so developed countries are working on many species of birds such as ostrich, rich chickens and Japanese quail1.

All poultry need light to live and modern farming practices usually require artificial lighting to meet this need. Light itself is a complex and varied phenomenon, made up of an entire spectrum of wavelengths and intensities. As such, light affects many aspects of growth and behavior in all manner of living organisms and must be taken into account when attempting to provide the most efficient controlled environment for poultry production. Poultry has evolved highly specialized visual systems to aid in their survival and much of poultry behavior is mediated by their vision12. If an ideal poultry production environment is to be created, one must understand how the birds will react to different light spectrums and intensities. The lighting is a primary factor in the posture of the birds, whose function is to stimulate the development of the reproductive system and the locomotor activity of the bird to higher food and water intakes3. Birds eyes are more sensitive to a broader spectrum than are human eyes because unlike humans’ 3 visual cone cells, birds have 4 to 5 cone cells, including a double cone that allows them to see in the ultraviolet spectrum4, were developed with the replacement of

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lamps commonly used for light emitting diode (LED), seeking to improve the production rates of birds and economic savings in lighting system because LEDs may be used up to 50,000 h much longer than incandescent and compact fluorescent lamps, which life is 1,000 and 8,000 h of use, respectively.

This paper was designed to collect data on LED characteristics that can be utilized as a basis for Quail housing illuminations in an effort to decrease the energy expense of the quail housing in the modern quail management.

The result of this paper is expected to overcome the shortage of the highly cost of electricity driven for artificial lighting fluorescent and other lighting sources.

**Materials and Method**

**Birds, Housing and Experimental Design:** A total of 180 quails (Coturnix coturnix) with initial age of one day. They were distributed in a completely randomized design (CRD) in 18 cages (0.80 x 0.40 x 0.50 m), with three treatments (Table 1) and six repetitions of ten quails each one in a total of 18 experimental units. The evaluation period was from, 1 to 49-day-old birds. The cages were equipped with feed trough and drinker type.

**Table 1: Treatments, Power and colour temperature**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Power (W)</th>
<th>Colour temp. (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED</td>
<td>12</td>
<td>6400</td>
</tr>
<tr>
<td>CFL</td>
<td>26</td>
<td>6500</td>
</tr>
<tr>
<td>INCAN</td>
<td>100</td>
<td>2700</td>
</tr>
</tbody>
</table>

W=watt, K= kelvin Light intensity: 40 lux per treatment

The lux measurement was taken using a digital light meter positioned at head height of birds in night shifts. The lighting system was connected to a timer in order to supply a continuous lighting program according to Table 2.

**Table 2: Lighting Program**

<table>
<thead>
<tr>
<th>Age (days)</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lighting</td>
</tr>
<tr>
<td>1-3</td>
<td>24</td>
</tr>
<tr>
<td>4-7</td>
<td>23</td>
</tr>
<tr>
<td>7-10</td>
<td>22</td>
</tr>
<tr>
<td>10-13</td>
<td>21</td>
</tr>
</tbody>
</table>

**Table 3: Commercial diets guarantee levels, used during the evaluation period**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>1-7 days</th>
<th>7-49 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>1</td>
<td>2.06</td>
</tr>
<tr>
<td>Fat</td>
<td>6.1</td>
<td>5.5</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.52</td>
<td>0.36</td>
</tr>
<tr>
<td>Fiber</td>
<td>2.7</td>
<td>6</td>
</tr>
<tr>
<td>Ash</td>
<td>6.6</td>
<td>11</td>
</tr>
<tr>
<td>Crude protein</td>
<td>22.5</td>
<td>19.87</td>
</tr>
<tr>
<td>Moisture</td>
<td>11.6</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Quail Performance and Carcass Yield: The performance parameters were evaluated weekly: feed intake (g/bird/week), average weight gain (g/bird/week) and feed conversion (g/g). The feed intake (g/bird/week) It were evaluated weekly by the weight of the feed that remain on the last day of the week (Feed Intake = (feed leftover/number of birds)/7 days). The average daily gain (g/bird/week) was evaluated weekly (AWG = ((initial weight-final weight)/n° birds/repetition)/7 days). The feed conversion corrected by daily mortality was calculated: (FC = FI/AWG).

At 35,42 and 49 days of age, six birds per treatment were slaughtered. The carcass yield (%) was calculated in relationship with the life weight before slaughter, {CY = [carcass weight (g) x100]/live weight}.
Biometrics Reproductive System: The weight of the ovarian weighed by a sensitive balance and the number of follicles per bird.

Statistical Analysis: The experimental data were analyzed using the full randomized design (CRD), and the averages were compared with the Duncan Multiple Range test to find the differences between them. The average subjects of Japanese quail subjected to LED light had no statistical significant difference (p<0.05) compared to that reared in the artificial lighting system using the statistical program, SAS Institute Inc., Cary, NC.27512-8000, USA.

Results

Quail Performance and Carcass Yield: No difference in quail performance (body weight, feed intake, weight gain and feed conversion during the period 1 - 49 day-old) was found (p>0.05) (Table 4).

Table 4: Body weight, weight gain, Feed intake and feed conversion of quail according to the treatments

<table>
<thead>
<tr>
<th>Period</th>
<th>Parameters</th>
<th>LED (g/quail/week)</th>
<th>CFL (g/quail/week)</th>
<th>INCAN (g/quail/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 weeks</td>
<td>BW</td>
<td>175.00 ± 4.74</td>
<td>5.39 ± 176.91</td>
<td>172.41 ± 5.25</td>
</tr>
<tr>
<td></td>
<td>BWG</td>
<td>32.11 ± 3.25</td>
<td>38.19 ± 4.25</td>
<td>35.58 ± 7.23</td>
</tr>
<tr>
<td></td>
<td>FI</td>
<td>3.82 ± 137.90</td>
<td>3.90 ± 131.22</td>
<td>5.08 ± 139.72</td>
</tr>
<tr>
<td></td>
<td>FCR</td>
<td>4.29 ± 0.58</td>
<td>3.43 ± 0.78</td>
<td>3.92 ± 2.18</td>
</tr>
<tr>
<td></td>
<td>CY</td>
<td>122.66 ± 2.27</td>
<td>117.33 ± 5.00</td>
<td>124.66 ± 7.02</td>
</tr>
<tr>
<td>6 weeks</td>
<td>BW</td>
<td>192.33 ± 6.22</td>
<td>192.00 ± 5.17</td>
<td>191.66 ± 5.86</td>
</tr>
<tr>
<td></td>
<td>BWG</td>
<td>17.33 ± 2.16</td>
<td>1.57 ± 15.08</td>
<td>19.25 ± 2.29</td>
</tr>
<tr>
<td></td>
<td>FI</td>
<td>138.86 ± 4.24</td>
<td>4.64 ± 137.59</td>
<td>140.75 ± 4.82</td>
</tr>
<tr>
<td></td>
<td>FCR</td>
<td>1.01 ± 8.01</td>
<td>1.91 ± 9.12</td>
<td>7.31 ± 1.47</td>
</tr>
<tr>
<td></td>
<td>CY</td>
<td>125.00 ± 1.96</td>
<td>126.83 ± 6.58</td>
<td>123.50 ± 4.14</td>
</tr>
<tr>
<td>7 weeks</td>
<td>BW</td>
<td>212.08 ± 8.25</td>
<td>210.00 ± 5.77</td>
<td>204.58 ± 3.89</td>
</tr>
<tr>
<td></td>
<td>BWG</td>
<td>19.75 ± 2.17</td>
<td>18.00 ± 3.80</td>
<td>13.08 ± 2.42</td>
</tr>
<tr>
<td></td>
<td>FI</td>
<td>153.44 ± 6.34</td>
<td>152.06 ± 6.46</td>
<td>150.70 ± 7.23</td>
</tr>
<tr>
<td></td>
<td>FCR</td>
<td>1.02 ± 7.76</td>
<td>2.13 ± 8.44</td>
<td>2.23 ± 11.52</td>
</tr>
<tr>
<td></td>
<td>CY</td>
<td>140.50 ± 3.52</td>
<td>141.00 ± 7.17</td>
<td>134.00 ± 8.65</td>
</tr>
</tbody>
</table>

BW= Body weight; BWG= Body weight gain; FI=Feed intake; FCR= Feed conversion ratio; CY= Carcass yield; (Value ± Standard error)

Biometrics Values of Gastrointestinal Tract: No significant differences were observed in the relative weight of Gizzard, Proventriculus, Liver and intestine in the three periods between the different treatments.

Table 5: Biometrics values of gastrointestinal tract of quail according to the treatments (Table 5)

<table>
<thead>
<tr>
<th>Period</th>
<th>Biometrics</th>
<th>LED (%)</th>
<th>CFL (%)</th>
<th>INCAN (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 weeks</td>
<td>Gizzard</td>
<td>2.49 ± 0.19</td>
<td>2.43 ± 0.24</td>
<td>2.62 ± 0.26</td>
</tr>
<tr>
<td></td>
<td>Proventriculus</td>
<td>0.306 ± 0.048</td>
<td>0.322 ± 0.050</td>
<td>0.325 ± 0.048</td>
</tr>
<tr>
<td></td>
<td>Liver</td>
<td>3.86 ± 0.30</td>
<td>3.36 ± 0.46</td>
<td>3.26 ± 0.43</td>
</tr>
<tr>
<td></td>
<td>Intestine</td>
<td>4.136 ± 0.464</td>
<td>4.710 ± 0.243</td>
<td>4.390 ± 0.209</td>
</tr>
<tr>
<td>6 weeks</td>
<td>Gizzard</td>
<td>2.63 ± 0.30</td>
<td>2.59 ± 0.22</td>
<td>2.83 ± 0.21</td>
</tr>
<tr>
<td></td>
<td>Proventriculus</td>
<td>0.361 ± 0.026</td>
<td>0.335 ± 0.026</td>
<td>0.384 ± 0.040</td>
</tr>
<tr>
<td></td>
<td>Liver</td>
<td>3.13 ± 0.37</td>
<td>2.96 ± 0.31</td>
<td>3.18 ± 0.34</td>
</tr>
<tr>
<td></td>
<td>Intestine</td>
<td>4.890 ± 0.548</td>
<td>4.549 ± 0.296</td>
<td>5.264 ± 0.728</td>
</tr>
</tbody>
</table>
Conted…

<table>
<thead>
<tr>
<th>7 weeks</th>
<th>Gizzard</th>
<th>2.82 ± 0.16</th>
<th>2.47 ± 0.13</th>
<th>2.48 ± 0.17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proventriculus</td>
<td>0.388 ± 0.059</td>
<td>0.346 ± 0.022</td>
<td>0.449 ± 0.030</td>
</tr>
<tr>
<td></td>
<td>Liver</td>
<td>3.25 ± 0.47</td>
<td>3.24 ± 0.46</td>
<td>3.24 ± 0.43</td>
</tr>
<tr>
<td></td>
<td>Intestine</td>
<td>5.555 ± 0.918</td>
<td>4.872 ± 0.409</td>
<td>4.688 ± 0.649</td>
</tr>
</tbody>
</table>

**Biometrics Reproductive System:** For the treatments no differences were observed (p>0.05) the relative weight of ovarian, oviduct and the number of ovarian follicles per bird at 5 weeks age. At the age of 6 weeks, the CFL treatment showed a significant increase in ovarian weight compared to INCAN treatment while LED treatment did not differ significantly from the different treatments. At the age of 7 weeks, CFL showed significant improvement in the number of ovarian follicles compared to INCAN. The high standard error is due to the fact that there are birds that have not yet reached sexual maturity, and that there is a wide variation in the weights of the reproductive system in the same treatment (Table 6).

**Table 6: Biometrics reproductive system of females quail according to the treatments**

<table>
<thead>
<tr>
<th>Period</th>
<th>Biometrics</th>
<th>LED</th>
<th>CFL</th>
<th>INCAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 weeks</td>
<td>Ovarian %</td>
<td>1.95 ± 1.56</td>
<td>1.72 ± 0.80</td>
<td>2.35 ± 2.22</td>
</tr>
<tr>
<td></td>
<td>Oviduct %</td>
<td>2.03 ± 1.00</td>
<td>2.37 ± 1.12</td>
<td>1.75 ± 1.51</td>
</tr>
<tr>
<td></td>
<td>No. of follicles</td>
<td>2.00 ± 2.00</td>
<td>4.33 ± 2.18</td>
<td>3.00 ± 3.00</td>
</tr>
<tr>
<td>6 weeks</td>
<td>Ovarian %</td>
<td>3.50 ± 0.34 ab</td>
<td>5.05 ± 0.47 a</td>
<td>0.58 ± 2.64 b</td>
</tr>
<tr>
<td></td>
<td>Oviduct %</td>
<td>4.38 ± 0.26</td>
<td>3.91 ± 0.48</td>
<td>3.51 ± 0.27</td>
</tr>
<tr>
<td></td>
<td>No. of follicles</td>
<td>4.00 ± 0</td>
<td>6.00 ± 0.57</td>
<td>3.33 ± 1.20</td>
</tr>
<tr>
<td>7 weeks</td>
<td>Ovarian %</td>
<td>3.66 ± 0.55</td>
<td>4.18 ± 0.69</td>
<td>3.38 ± 0.89</td>
</tr>
<tr>
<td></td>
<td>Oviduct %</td>
<td>3.13 ± 0.21</td>
<td>2.90 ± 0.36</td>
<td>3.37 ± 0.48</td>
</tr>
<tr>
<td></td>
<td>No. of follicles</td>
<td>4.33 ± 0.66 ab</td>
<td>6.00 ± 0.57 a</td>
<td>2.66 ± 0.66 b</td>
</tr>
</tbody>
</table>

A, B Different letter within column significantly different (p<0.05)

**Discussion**

The all groups conducted in this previous study did not demonstrate any difference between LED, CFL and INCAN lighting in Quails performances and carcass yield. These results agree with Almeida *et al.*9 and Molino *et al.*10. However, did not agree with Nunes *et al.*11 who was observed an increase in growth in broilers raised under LED or CFL when compared to INCAN.

As for the gastrointestinal tract parameters and reproductive system this study agrees with Wagan *et al.*12. Nevertheless, it did not present to have an effect on development of the reproductive system of pre-laying birds. The increase in the relative weight of the ovary at 6 and 7 weeks, may be attributed to an increase in the number of ovarian follicles13. Due to increased vitamin D3 formation, which is essential for the growth of the female reproductive system, where receptors are found in a wide range of ovarian follicles in it14. The light wavelength penetrates the skull of the chickens to stimulate the pineal and pituitary glands, which control the secretion of reproductive hormones such as Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH) and 17 Estradiol (E2), these hormones enhance the growth and number of ovarian follicles changing the development of the reproductive tract of birds15-16.

**Conclusions**

The live performance and gastrointestinal tract parameters and reproductive of Japanese quails exposed to LED source were similar to those exposed to CFL lamp and INCAN lamp. Therefore, CFL and INCAN lamps may be replaced by LED light sources. It is concluded that, it is possible to use the LED lighting system, in order to minimize energy expenses in quail housing facilities.
Significance Statement: This study connected for the first time in Tikrit University in Iraq, in the progress of Japanese quail production to obtain high economic profit by application of LED lighting system.

Acknowledgment

We would like to thank all staff and workers in Animal Production Department, Faculty of Agricultural College, Tikrit University who helped us to achieve this work.

Conflict of Interest: This research is a personal non-profit work and there is no conflict of interest.

Source of Funding: None.

Ethical Clearance: Ethical clearance was obtained from the Faculty Scientific Committee (Department of Animal Production, College of Agriculture, Tikrit University, Salahaddin, Iraq) to study the effect of using different healthy lighting sources on some productive and physiological characteristics of Japanese quail.

REFERENCES


Protective Effect of Roket Leaves (Eruca Sativa) Extract against Lead Induced Oxidative Damage in Liver and Kidney of Male Rats

Ahmed Jasim Nawfal¹, Haithm T. Tafash¹, Anmar Shukr Mahmood²

¹Department of Physiology, ²Department of pharmacology, College of Medicine, University of Fallujah, Iraq

ABSTRACT

This study was intended to examine the prophylactic function of ethanolic extract of Eruca sativa leaves against the toxic effects of lead acetate on liver and kidney enzymes in male of rats. 32 adult male rats 175-200 gm were randomly divided into four equal groups (8 rats/group) and were treated for 10 weeks as follows: Rats of the first group were received tap water which considered as control group, Second group T₁ animals in this group administrated 2.5 mg/Kg B.W lead acetate, Third group T₂ animals in this group were received 2.5 mg/KgB.W lead acetate plus 300 mg/kg. B.W. of Eruca sativa extract, Fourth group T₃ animals in this group was received 300 mg/kg. B.W. of Eruca sativa extract. Serum liver and kidney functions tests were evaluation. The results manifest that the Eruca Sativa extracts at concentration 300mg/kg B.W improved liver and kidney functions. We accomplished that, Eruca sativa extracts may appear their protective and treatment effect against oxidative damage result from lead acetate by rising/preserve the grade of antioxidant enzymes and antioxidant molecules. The histological section showed the pathological changes in the liver and tissue in T₁ group while giving Eruca Sativa extract with and without lead acetate was effective in modified these changes into semi normal, the results assert the prophylactic effect of E. sativa leaves extract against oxidative damage due to lead acetate in rats.

Keywords: Eruca sativa, Hydrogen peroxide, ALT, AST, BUN, Creatinine, liver, kidney

Introduction

“There has been a great deal of interest in the role of complementary and alternative medicines for the treatment of different acute and chronic diseases. Various hundreds of plants have been examined for use in a wide variety of liver and kidney disorders including Eruca sativa (Family: Cruciferae) that modulate oxidative stress due to its antioxidant properties. All culture used plants as sources of food due to their fundamental nutritional importance, physiological role, and as pharmaceutical substances ¹”. “So they count as integral and stand by medicine ²”. E. sativa possesses antisecretory, antiinflammatory, anticancer, cytoprotective and antiulcer activity versus experimentally stimulated gastric lesions which is possibly result from prostaglandin-mediated action and/or meanwhile antisecretory activity ³,⁴, yet, it was notify that E. sativa leaves and seed are powerful antioxidants ⁵,⁶,⁷, indicated that E. sativa seeds and leaves possessed a potent free radical scavenging antioxidants and protected against oxidative damage by rising/preserve the grade of antioxidant enzymes and antioxidant molecules. It has been convey which is the ethanolic extract of E. sativa has an androgenic action or catalyze testicular steroid output which promote the preputial gland moreover increasing spermatogenesis in the testis of male ⁸. In addition, E. sativa acts as anti-cancer ⁹.

Material and Method

Plant Extraction: The fresh leaves of Eruca sativa were collected from local market and air dried in the shade, grounded into a fine powdered, and weighing 100 gm
then put it in a volumetric conical flask 1000 ml of 70 % ethyl alcohol was added on the powder which makes the ratio (1/10) (W/V). After that the mixture was shook by using magnetic stirrer apparatus for (24hr), the mixture was filtered by using 4 layers of medical gauze then was filtered again using Whatman No.1 filter paper. The filtrated mixture was concentrated by using incubator on (40°C) for 72hr, to obtain crude extract. This yield equal of 10 gm, the extract was stored in a dark sterile screw bottle in (4°C) until use. 10.

Experimental Animals: Thirty two healthy adult males’ wistar rats, weighed 175-200 gm was used. Animals were randomly divided into four equal groups, and treatment for 10 weeks as follow: first group (control): Animals in this group were received tap water as control, second group (T1): Animals in this group were received 2.5 mg/Kg.B.W. lead acetate (250 mg/100ml) dissolved in tap water daily, third group (T2): Animals in this group were administration “2.5 mg/Kg B.W. lead acetate (250 mg/100ml)” dissolve in tap water daily plus 300 mg/kg. B.W. ethanolic extract of Eruca sativa leaves, fourth group (T3): Animals in this group were received 300 mg/kg. B.W. ethanolic extract of Eruca sativa leaves. Blood samples were collected at zero day and 10 weeks of the experiment. Blood was drawn by cardiac puncture technique from rats anesthetized by intramuscular admission of (Ketamine 90mg/Kg B.W. and Xylazine 40mg/kg B.W.). Blood specimens were preserved in tubes and used centrifuge at 3000 rpm for 10 minutes, and then serum samples were a liquidated and frosted at -20°C till analysis and the serum was used for the assay of marker enzymes aspartate aminotransferase (AST/GOT), alanine aminotransferase (ALT/GPT), Blood Urea nitrogen (BUN) and Creatinine.

Statistical Analysis

Data in tables and figures are showed as mean ± S.E. value were resolved using SPSS version 22. Variance between groups was tested by a one-way analysis of variance (ANOVA). P value ≤0.001 were considered significant. Also, canonical correspondence analysis (CCA) used in present study.

Result

Statistical analysis of the result indicated no significant differences in the mean value of aspartate aminotransferase (AST), Alanine aminotransferase (ALT), blood urea nitrogen (BUN) and creatinine enzymes activities concentration in all experimental groups when parallel to each other at the pretreated period. The result that reported in table (1) is showed that intubation of rats with lead acetate group (T3) for 10wks cause significant (P<0.001) rises in the mean value of ALT concentration in the serum at 10wks (66.33 ± 2.54) of treatment as compared to control and T2 groups (32.17 ± 1.54), (40.67 ± 1.84), while T3 group (28.50 ± 0.99) show no differences with control group.

Depending on the results clarified in table (1) there was a significant change (P<0.001) in serum AST activity in T3 group (168.33 ± 1.41) as compared with the T2 group that showed little significant change (P<0.001) (142.50 ± 2.95). Though the control and T3 groups did not differ between them (130.17 ± 2.15), (124.50 ± 1.52) as compared with group T1 and T2 (168.33 ± 1.41), (142.50 ± 2.95) after 10wks of experiment. Table (2) illustrates the mean values of BUN concentration in the control and four treated groups along the experimental period showed a significant (P<0.001) decrease in the mean value of serum BUN concentration were observed after ES leaves extract intubation in group T3 (0.66 ± 0.02) comparing to T1 and T2 treated groups (1.12 ± 0.02), (0.80 ± 0.01). The results are demonstrated the effect of lead acetate in table (2) showed a significant (P<0.001) increase in the serum of creatinine concentration in animals of group T1 (1.12 ± 0.02) as compared with the control and group T3 (0.72 ± 0.01), (0.66 ± 0.02) during all periods of experiment. On other hand, a significant (P<0.001) increase in creatinine concentration was observed in T3 treated group (0.80 ± 0.01) at the end of experiment compared to pretreated period.

Discussion

In this study, lead acetate administrated rises the mean values of liver enzymes ALT and AST (Table.1). This results were in harmony with 12 which indicated that exposure of hepatocytes to oxidative stress modify the membrane structure and functions by increasing the liberation of enzymes into the blood stream”. Also 13 reported that excess oxidative stress has been connected with changing liver metabolism and liver damage. In prophylactic groups (T1) and Eruca sativa ethanolic extracts treated group (T3), liver enzymes (AST and ALT) were significantly decreased compared to lead acetate group (T2). This results were in consent with 14.


who mentioned that administration of rocket resulted in promoting in ALT and AST actions of male rabbits, that may possibly due to the increase sulfur component in *Eruca sativa* that act as a removing of body wastes, removing congestion such as sinusitis and assisting the liver and immune functions $^{15,16}$.

**Table 1: Effect of *Eruca sativa*, lead acetate and *Eruca sativa* plus lead acetate on serum AST and ALT concentration (U/L), in male rats**

<table>
<thead>
<tr>
<th></th>
<th>AST test</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control Group</td>
<td>Group T$_1$ (Lead)</td>
<td>Group T$_2$ (Lead + ES)</td>
<td>Group T$_3$ (ES)</td>
<td></td>
</tr>
<tr>
<td><strong>Zero</strong></td>
<td>126.33 ± 2.43</td>
<td>127.33 ± 2.35</td>
<td>127.50 ± 1.18</td>
<td>128.33 ± 2.26</td>
<td></td>
</tr>
<tr>
<td><strong>10wks</strong></td>
<td>130.17 ± 2.15</td>
<td>168.33 ± 1.41</td>
<td>142.50 ± 2.95</td>
<td>124.50 ± 1.52</td>
<td></td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>0.265</td>
<td>0.000</td>
<td>0.001</td>
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<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control Group</td>
<td>Group T$_1$ (Lead)</td>
<td>Group T$_2$ (Lead + ES)</td>
<td>Group T$_3$ (ES)</td>
<td></td>
</tr>
<tr>
<td><strong>Zero</strong></td>
<td>31.17 ± 2.01</td>
<td>32.17 ± 2.02</td>
<td>31.67 ± 2.58</td>
<td>33.50 ± 2.62</td>
<td></td>
</tr>
<tr>
<td><strong>10wks</strong></td>
<td>32.17 ± 1.54</td>
<td>66.33 ± 2.54</td>
<td>40.67 ± 1.84</td>
<td>28.50 ± 0.99</td>
<td></td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>0.701</td>
<td>0.000</td>
<td>0.017</td>
<td>0.104</td>
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</table>

There was a significant effect of oxidative stress on kidney functions level in serum of adult male rats. The levels of BUN and creatinine in serum (Table.2) were significantly increased with increasing of oxidative stress, also when the antioxidants of the liver or kidney are low, or when the liver/kidney is suffering from oxidative insults, the damages caused by free radicals would increase, leading to inflammation and fibrosis $^{17}$.

**Table 2: Effect of *Eruca sativa*, Hydrogen peroxide and *Eruca sativa* plus Hydrogen peroxide on serum creatinine and BUN concentration (mg/dl), in adult male rats**

<table>
<thead>
<tr>
<th></th>
<th>BUN test</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control group</td>
<td>Group T$_1$ (Lead)</td>
<td>Group T$_2$ (Lead + ES)</td>
<td>Group T$_3$ (ES)</td>
<td></td>
</tr>
<tr>
<td><strong>Zero</strong></td>
<td>0.71 ± 0.03</td>
<td>0.73 ± 0.02</td>
<td>0.71 ± 0.02</td>
<td>0.72 ± 0.02</td>
<td></td>
</tr>
<tr>
<td><strong>10wks</strong></td>
<td>0.72 ± 0.01</td>
<td>1.12 ± 0.02</td>
<td>0.80 ± 0.01</td>
<td>0.66 ± 0.02</td>
<td></td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>0.837</td>
<td>0.000</td>
<td>0.002</td>
<td>0.092</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<th>Creatinine test</th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
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<td>Control group</td>
<td>Group T$_1$ (Lead)</td>
<td>Group T$_2$ (Lead + ES)</td>
<td>Group T$_3$ (ES)</td>
<td></td>
</tr>
<tr>
<td><strong>Zero</strong></td>
<td>0.71 ± 0.03</td>
<td>0.73 ± 0.02</td>
<td>0.71 ± 0.02</td>
<td>0.72 ± 0.02</td>
<td></td>
</tr>
<tr>
<td><strong>10wks</strong></td>
<td>0.74 ± 0.01</td>
<td>1.18 ± 0.02</td>
<td>0.82 ± 0.01</td>
<td>0.65 ± 0.02</td>
<td></td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>0.837</td>
<td>0.000</td>
<td>0.002</td>
<td>0.092</td>
<td></td>
</tr>
</tbody>
</table>

Values are expressed as mean ± SE, n = 8 animals/group.

The main component that showed antioxidant activity in E.S. extract is glucorucin, diverse from other glucosinolates (GLS), glucorucin (GER) have good direct as well as indirect antioxidant action$^{15}$.

Histological sections obtained from rat kidney exposed to 2.5 mg/Kg B.W. lead acetate (T$_1$) at the termination of the experiment revealed inflammatory cells aggregation around collected ducts and congested vessels, there is also congested blood vessels between renal tubules with severe vacuolar degeneration of epithelial cells of renal tubules, atrophy of glomerular tufts with acute cellular degeneration of epithelial cells of the renal tubules (Fig.1- B,C) comparing to control group (Fig.1.A), while kidney treated with 2.5 mg/Kg B.W. lead plus ethanolic extract of (300 mg/kg B.W) E. S (T$_2$) showed no clear lesions (Fig.2-A). Normal obvious histological architecture of kidney in animals of group T$_3$ (Fig.2-B) comparing to the other treated group (T$_1$ and T$_2$).
Rats of group T₁ showed necrosis of hepatocytes with neutrophils in dilated congested sinusoids and central veins, neutrophils infiltrated in large necrotic area and present in dilated sinusoids (fig.3-B) as compared to control group and T₃ group that there is no clear lesion. Whereas, Cross section of the liver of rat treated with 2.5mg/Kg B.W. lead and (300 mg/kg B.W) *Eruca sativa* (T₂) shows proliferation of kupffer cells and granulomatous lesion consisting from aggregation of active macrophages and lymphocytes (fig.3-C) as compared with control group (Fig.3-D). Meanwhile, the histopathological sections of liver of group T₃ showing normal structure and no clear lesion (Fig.9) comparing to group T₁ (Fig. 7).

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**Figure 1:** (A) Cross section of the kidney of rat (control group) shows normal structure of the kidney (H&E stain 40X). (B) Cross section of the kidney of rat treated with 2.5 mg/Kg B.W. lead (T₁) shows congested vessels between renal tubules and inflammatory cells aggregation around collected ducts with severe vacuolar degeneration of epithelial cells of renal tubules (H&E stain 40X). (C) Cross section of the kidney of rat treated with 2.5 mg/Kg B.W. lead (T₁) shows atrophy of glomerular tufts with acute cellular degeneration of epithelial cells of renal tubules (H&E stain 40X).

**Figure 2:** (A) Cross section of the kidney of rat treated with 2.5 mg/Kg B.W. lead and (300 mg/kg B.W.) *Eruca sativa* (T₂) notified no clear lesions (H&E stain 40X). (B) Cross section of the kidney of rat treated with (300 mg/kg B.W.) *Eruca sativa* (T₃) shows no clear lesions (H&E stain 40X)

**Figure 3:** (A) Cross section of the liver of rat (control group) notified normal no clear lesions (H&E stain 40X), (B) liver of rat treated with 2.5 mg/Kg B.W. lead (T₁) shows necrosis of hepatocytes with neutrophils in dilated congested sinusoids and central veins (H&E stain 40X), (C) liver of rat treated with 2.5 mg/Kg B.W. lead and (300 mg/kg B.W) *Eruca sativa* (T₂) shows proliferation of kupffer cells and granulomatous lesion consisting from aggregation of active macrophages and lymphocytes (H&E stain 40X) and (D) liver of rat treated with (300 mg/kg B.W) *Eruca sativa* (T₃) shows normal tissue and no lesions (H&E stain 40X).

Many statement are present in the literature about normalization antioxidant action of alcoholic extract of *E. sativa* and low levels of lipid peroxidation (LPO) and nitric oxide (NO)¹⁸. *E. sativa* extracts may exercise this protective and treatment role against oxidative damage result from CCl₄ by rising/preservative the grade of antioxidant molecules and enzymatic antioxidant¹⁹.
**Conclusion**

The current study it could be concluded that the leaves of ethanolic extracts of *Eruca sativa* have both protective and therapeutic role against experimentally lead to liver and kidney damage by lead acetate in rats. However, the protective effect of these extracts was stronger than their treatment ability.

**Conflict of Interest:** There is no conflict of interest.

**Ethical Consideration:** Ethical approval for this study was obtained from the scientific committee of the College of Medicine, University of Falluja. Participants were given the choice to participate in the study and were informed that all the information taken would be kept strictly confidential and would only be used for research purposes. Verbal consent was obtained from the participants, who were permitted to respond in their own time and privacy, after researchers explained the aim of the research.

**Source of Funding:** No funding was received from any committee or association.

**REFERENCES**


Role of Serum Osteopontin and Osteoprotegerin Levels in Diagnosis of Acute Coronary Syndrome and Its Subtypes

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ABSTRACT

Background: Acute coronary syndrome (ACS) is the major acute clinical manifestation of coronary heart disease (CHD). The term ACS includes ST-elevation myocardial infarction (STEMI), non-ST elevation (NSTEMI) and unstable angina (UA).

Objectives: To measure serum levels of osteopontin (OPN), osteoprotegerin (OPG) in ACS patients with its subtyping and to study the association of their levels with extent of cardiac injury.

Methodology: Patients (≥30 years) were consecutively selected after have been diagnosed as STEMI (n=60), NSTEMI (n=24) and UA (n=36) depending on clinical evaluation, electrocardiography and troponin testing. Healthy (n=64), age- and sex-matched subjects were taken as controls. For each study subject, clinical characteristics were recorded and the serum OPN, OPG, and troponin I-3 (cTn-I-3) were measured.

Results: OPN level was significantly higher in ACS patients than in controls and showed a correlation with cTn-I-3 level. There was a graded increase in its level from UA to NSTEMI and then to STEMI patients. OPN had area under the curve (AUC) of 0.897, a sensitivity of 82.5%, a specificity of 99.29%, and a diagnostic accuracy of 88.34% in discrimination between ACS patients and controls. OPG was significantly higher in STEMI subgroup and in NSTEMI subgroup than in controls but not between UA and controls. Additionally, the mean level was significantly higher in STEMI than in NSTEMI subgroup and was also higher in NSTEMI than in UA but the difference did not reach statistical significance.

Conclusion: The study detection of significant increases in OPN and OPG levels in all or certain subtypes of ACS patients than in controls may be of value in their use as adjuvant to cTn in earlier diagnosis and management of ACS patients.

Keywords: Acute coronary syndrome, Osteopontin, Osteoprotegerin, Coronary heart disease, body mass index

Introduction

Acute coronary syndrome (ACS) is the major acute clinical manifestation of coronary heart disease (CHD). It describes a continuum of cases of myocardial ischemia that involves acute myocardial infarction (MI) with ST-segment elevation on electrocardiogram and is abbreviated as (STEMI), MI with no ST-segment elevation (NSTEMI), and unstable angina (UA). Because UA and NSTEMI characterizes by the absence of ST segment elevation, they are collectively termed as non ST-segment elevation ACS (NSTE-ACS)¹. Diagnosis and clinical subtyping among the heterogeneous patients who present with suspected ACS need to be improved such as by finding other biomarkers of ACS. Osteopontin (OPN) is a glycoprotein that is normally produced in bone, kidney, brain, and epithelial lining tissue in both insoluble extracellular matrix-associated and soluble forms²,³.

The first opinion about a role for OPN in CVD was based on finding elevated serum levels in patients having established vascular calcification and in diseases that are associated with severe vascular remodeling including hypertension, chronic kidney disease, and diabetes mellitus⁴,⁵. Accordingly, OPN was thought of as an emerging risk factor or a biomarker with possible predictive value for CVD⁶,⁷. Recently it has been shown that OPN expression in atherosclerotic plaques is closely associated with the “severity of atherosclerosis and calcification” and that a high concentration of OPN...
could be responsible for a number of changes within the atherosclerotic plaque that would promote plaque instability. Importantly, this protein also showed an association with atherosclerotic decalcification, a change that might favor plaque rupture.\(^3\)

Osteoprotegerin (OPG) is a cytokine receptor that is a member of the Tumour Necrosis Factor Receptor superfamily of proteins. It is also known as osteoclastogenesis inhibitory factor. OPG has a role in bone metabolism but also has roles in inflammation and in processes where cell differentiation, survival and death are controlled\(^4,9\). OPG is described as a vascular modulator that is linked with the occurrence and progression of atherosclerosis and with risk of CHD\(^10\). This study aimed to measure serum levels of OPN & OPG in ACS patients, to investigate their value in diagnosis and subtyping of ACS and to study the association of their levels with the extent of cardiac injury.

Materials and Method

Patients Group: Patients were recruited from the coronary care units in Al-Yarmouk Teaching Hospital during the period between 1\(^{\text{st}}\) November 2017 and 1\(^{\text{st}}\) April 2018. One hundred and twenty patients (77 males and 43 females, \(\geq 30\) years) were diagnosed to have ACS and were included in the study after consideration of pre-defined exclusion criteria.

Diagnoses of ACS subtypes that are STEMI, NSTEMI, and UA were based on the presence of two out of three findings, which are clinical presentation, ECG changes, and positive troponin by onsite troponin combo rapid test.

Exclusion Criteria: Patients who have any of following conditions had been excluded: Presentation at more than 36 hr after onset of chest pain, or having renal failure, stroke, skeletal muscle injury or trauma, or being on an intake of statins or any hypo-lipidemic drug. In addition, if age is \(<30\) years or having abdominal enlargement for any reason other than central obesity or if the patient is of another nationality (non-Iraqi), or in case of prior inclusion in the present study. Besides that if a patient had a known history of thyroid, hepatic, or malignant disease, or had anemia (Hb\(<9\)g/dl for males and Hb\(<8\)g/dl for females) or is being an alcohol drinker. Additionally, if had a concurrent infectious disease, valvular heart disease or was being unable to relate the time that his or her symptoms began or ended (if the pain was not persisting).

Control Group: Healthy subjects were recruited who had no CHD symptoms and no history of coronary heart disease on interviewing. They were age–matched to the study patients and also comply with the criteria of exclusion in the patients group. They comprised 64 subjects (41 males and 23 females) who had no diabetes mellitus or hypertension and were not smokers.

Clinical Measurements and Investigations: Height and weight of each study subject were recorded to calculate body mass index (BMI) according to the following formula (BMI= Weight in kilograms/(Height in meters\(^2\)).

Blood Analyses: The blood was collected within 6-36 hr from onset of chest pain. At first, there was an immediate blood testing for detection of cardiac troponin–I (cTn-I) on admission of a suspected patient by using a qualitative test which is the onsite troponin-I combo rapid test. Immediately afterwards, a fasting blood sample and aliquots of serum were used for assay of levels of glucose, cholesterol and aspartate transaminase by enzymatic spectrophotometric methods as well as estimation of human OPN, OPG and cTn-I-3 concentrations by enzyme linked immune sorbent assay using ELISA kits that were purchased from MyBioSource company, USA.

Estimation of cTn-I by Onsite Troponin Combo Rapid Test: For differentiation between NSTEMI and UA patients an Onsite troponin-I combo rapid test was used. It is a qualitative test that uses a lateral flow chromatographic immunoassay for detection of cardiac troponin - I (cTn-I) and its complex in human serum, plasma or whole blood at a level equal to or higher than 1ng/ml.

Estimation of Osteopontin, Osteoprotegerin, and Human Cardiac Troponin I-3: Human OPN, OPG, and cTn-I-3 concentrations were measured by ELISA.

Statistical Analysis

The data were represented as mean ± SD. To find out differences in the levels of serum biomarkers among study groups and among ACS subgroups, comparisons of their levels was made among related groups and subgroups. ANOVA was used to evaluate for the significance level.
**Results**

**Clinical Characteristics of Study Patients:** The BMI of control, UA, NSTEMI and STEMI was found (p=0.262) to be 28.21 ± 3.83, 26.65 ± 2.78, 28.07 ± 2.68 and 28.77 ± 3.72 kg/m². The fasting blood sugar of control, UA, NSTEMI and STEMI was found (p=0.0001) to be 92.66 ± 18.93, 206.26 ± 92.66, 193.41 ± 87.35 and 180.93 ± 92.96 kg/m². The cholesterol of control, UA, NSTEMI and STEMI was found (p=0.008) to be 179.38 ± 37.21, 154.88 ± 31.93, 180.29 ± 52.17 and 186.97 ± 56.42 mg/dl.

**Comparison of OPn & OPG among Subtypes of ACS:** Cardiac injury marker i.e. cTn-I-3 are depicted in Table 1. Additionally, the mean level was significantly higher in STEMI than in NSTEMI subtypes and was also higher in NSTEMI than in UA but the difference did not reach statistical significance (P<0.065).

Table 1: Comparison of troponin-I, osteopontin (OPN) and osteoprotegerin (OPG) levels among study groups

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Troponin-I Mean (pg/ml)</th>
<th>P-value</th>
<th>OPN Mean (pg/ml)</th>
<th>P-value</th>
<th>OPG Mean (pg/ml)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEMI(n=60)</td>
<td>254.41 ± 186.7</td>
<td>0.125(A vs. B)</td>
<td>0.125(A vs. B)</td>
<td>0.125(A vs. B)</td>
<td>0.125(A vs. B)</td>
<td>0.125(A vs. B)</td>
</tr>
<tr>
<td>NSTEMI(n=24)</td>
<td>212.14 ± 80.57</td>
<td>0.001(B vs. C)</td>
<td>0.001(B vs. C)</td>
<td>0.001(B vs. C)</td>
<td>0.001(B vs. C)</td>
<td>0.001(B vs. C)</td>
</tr>
<tr>
<td>UA(n=36)</td>
<td>74.60 ± 21.05</td>
<td>0.000(D vs. E)</td>
<td>0.000(D vs. E)</td>
<td>0.000(D vs. E)</td>
<td>0.000(D vs. E)</td>
<td>0.000(D vs. E)</td>
</tr>
<tr>
<td>Control(n=64)</td>
<td>66.26 ± 38.83</td>
<td>0.725(C vs. D)</td>
<td>0.725(C vs. D)</td>
<td>0.725(C vs. D)</td>
<td>0.725(C vs. D)</td>
<td>0.725(C vs. D)</td>
</tr>
</tbody>
</table>

A vs. D and A vs. C are found to be 0.000. F-test is 36.26 with p value >0.01.

**Correlations of OPN and OPG with Troponin 0-I 3 in the Subgroups of ACS:** The correlations of study parameters with troponin-I-3 in the subgroups of ACS are shown in Table 2. OPN showed a significant positive correlation with cTn-I-3 in STEMI and NSTEMI while OPG showed only in NSTEMI.

Table 2: Correlations of OPn & OPG with Troponin-I-3 in Subgroups of ACS

<table>
<thead>
<tr>
<th>ACS Subgroup</th>
<th>OPN (pg/ml)</th>
<th>OPG(pg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEMI N = 60</td>
<td>r 0.257*</td>
<td>-0.103</td>
</tr>
<tr>
<td></td>
<td>p 0.048</td>
<td>0.435</td>
</tr>
<tr>
<td>NSTEMI N = 24</td>
<td>r 0.618**</td>
<td>0.254*</td>
</tr>
<tr>
<td></td>
<td>p 0.001</td>
<td>0.045</td>
</tr>
</tbody>
</table>

**Receiver Operator Characteristic (ROC) Curve Analysis:** ROC curve analysis was used as a statistical method to evaluate the ability of a laboratory test as a classifier of a certain group of subjects as having a disease or not according to a test result. This ability is measured as an AUC in ROC curve analysis for the test results. By determining an appropriate cut-off point or value for the test results, the sensitivity and specificity of a test at that cut-off value were calculated and the percent combined diagnostic accuracy of the test at that cut-off value was also estimated. Depending on the presence of ACS as diagnosed by the measures used then (clinical assessment, ECG, and cardiac troponin level), the predictive values of serum levels of OPN and OPG are presented in Figure 1 and Table 3.

![Figure 1](image-url)
The area under receiver operator characteristic (ROC) curve of acute coronary syndrome (ACS) for OPN and OPG was 0.897pg/ml (p=0.0001) and 0.628pg/ml (p=0.003) versus controls. The area under receiver operator characteristic (ROC) curve of NSTEMI for OPN and OPG was 0.519pg/ml (p=809) and 0.808pg/ml (p=0.0001) versus unstabel angina.

Table 3: The best discriminative cut-off values of study parameters that best predicted ACS patients versus controls

<table>
<thead>
<tr>
<th>Parameters (pg/ml)</th>
<th>Cut-off value</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Diagnostic accuracy %</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS patients versus controls</td>
<td>OPN</td>
<td>10.44</td>
<td>82.5</td>
<td>99.29</td>
</tr>
<tr>
<td></td>
<td>OPG</td>
<td>444.19</td>
<td>74.2</td>
<td>38.60</td>
</tr>
<tr>
<td>NSTEMI versus unstable Angina subgroups of ACS</td>
<td>OPN</td>
<td>10.97</td>
<td>62.5</td>
<td>27.8</td>
</tr>
<tr>
<td></td>
<td>OPG</td>
<td>560.55</td>
<td>75</td>
<td>67</td>
</tr>
</tbody>
</table>

Discussion

Serum biomarkers, principally the cardiac troponins, are complementary to the clinical evaluation and ECG in the diagnosis, triage, and management of patients with suspected ACS. Therefore, the diagnosis and clinical subtyping among the heterogeneous patients who present with suspected ACS may be improved by finding other biomarkers to complement the use of already present biomarkers. In such a search for new markers that may aid in diagnosis of ACS, this study has evaluated certain bone metabolism biomarkers in patients diagnosed to have ACS.

This study revealed that OPN mean level was significantly higher in ACS patients than in apparently healthy subjects. This finding is consistent with previous studies that reported an elevated OPN level in patients with acute myocardial infarction\(^\text{15}\) and in symptomatic patients referred for coronary angiography\(^\text{12,13}\) or in symptomatic patients referred for echocardiographic characteristics of atherosclerosis\(^\text{14,15}\). Also, there was a significant correlation between OPN and the cardiac muscle injury biomarker, which is cTn-I-3 that may suggest an association of OPN level with the extent of myocardial damage and so may support its use as adjuvant to cTn in the management of ACS patients. These results are in agreement with the findings in other studies\(^\text{16}\). That association of OPN level with the extent of myocardial damage may be via a role of OPN in advancement of coronary atherosclerotic lesions themselves or just as part of the inflammatory process that accompanies cardiac muscle necrosis in STEMI and NSTEMI patients. The study finding of higher level in STEMI than in NSTEMI patients and even significantly higher level in UA patients than in controls in spite of no cardiac muscle necrosis in UA is more in favor of advanced atherosclerotic lesion that culminate in the process of atherosclerotic plaque rupture and its complication irrespective of cardiac muscle necrosis.

Regarding that acute coronary syndrome represents a difficult diagnostic challenge in subjects presented with undifferentiated chest pain and probably a non-diagnostic ECG and normal troponin, then receiver operating characteristic (ROC) curve analysis was used to explore predictive value of serum OPN level in discrimination between ACS patients and controls. OPN had AUC of 0.897, a sensitivity of 82.5%, specificity 99.29%, and a diagnostic accuracy of 88.34%. Such a finding suggests that OPN may be useful in undifferentiated acute chest pain with non-diagnostic ECG and normal troponin or may be added to cTn-I and leads to an earlier diagnosis and management of ACS.

Many previous studies showed that levels of OPG were higher in patients with acute coronary syndrome compared with stable angina or healthy controls\(^\text{17-19}\). So, the study finding of no significant difference between UA and controls as well and the modest difference between NSTEMI and UA is noticeable. It may be explained by the results of other studies that showed that the levels of OPG were associated with the severity of CHD\(^\text{20}\). However, this was not confirmed in other studies that reported that coronary obstructive lesion score was not associated with the OPG levels\(^\text{21}\).

The study findings of the pattern of increase in serum OPG level in ACS patients again suggest a possible adjuvant diagnostic value of OPG in patients with
suspected ACS particularly in the presence of higher level in NSTEMI subgroup than UA subgroup and the significantly higher level in NSTEMI subgroup than controls. ROC analysis had revealed that the highest AUC value for OPG was in discrimination between NSTEMI and UA subgroups with a good sensitivity (75%) and diagnostic accuracy (70.02%) when the best cut-off value of OPG level was selected in such discrimination, an issue that is critically needed in the management of ACS patients. Although a clinical application of any diagnostic value of OPG needs further studies, the present results give a clue that measurement of a multitude of biomarkers such as OPG and OPN in combination may provide more useful and clinically relevant information. It can be concluded that the significantly increased serum OPN level in ACS patients may be useful in undifferentiated acute chest pain particularly with finding of an association of OPN level with the extent of myocardial damage that supports its use as adjuvant to cTn in the management of ACS patients. Also the finding on ROC curve analysis, that OPG level has the highest AUC value may be useful in discrimination between NSTEMI and UA subgroups, an issue which is critically needed in management of ACS patients.

Ethical Clearance: Consent was taken from all study subjects after being told about the aim of the study and the study project was approved by the institutional scientific committee.

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES
2. Vaschetto RS, Nicola C, Olivieri et al., Serum levels of osteopontin are increased in sirs and sepsis, Intensive care medicine, 2008,34:2176–2184.


Biochemical Study and Immunohistochemistry of Breast Cancer after and before Radiotherapy

Aqeel Shakir Mahmood

Department of Surgery–college of Medicine/University of Baghdad

ABSTRACT

Across-sectional study was conducted in medical city complex, Baghdad, Iraq and baghdad teaching hospital, oncology teaching hospital. The complete physical examination was finished to every patient during the period from October 2016 to January 2017 with age range 20-40. The study included 30 patients divided two groups the group 1 before radiotherapy (new diagnosis with malignant breast cancer), and group 2 after radiotherapy (the same group 1). The last diagnosis was established by aspiration of cysts using (FNA) and mammography. Blood samples and biopsy from breast were taken from 30 women new diagnosis of malignant breast cancer and again take blood and biopsy after radiotherapy from the same women. The result shows high significantly increase of MDA levels (p<0.01) when comparing radiotherapy group (after radiotherapy) with the malignant group (before radiotherapy). A significant change of uric acid at (p<0.05) in comparison of radiotherapy group with the malignant group (p<0.05). A significantly lower level in albumin, Urea, creatinine, and Vitamin E at (p<0.05) of the malignant group in relation to radiotherapy group, while a non-significant change in Vitamin A (p>0.05) when comparing the malignant group and radiotherapy group.

Keywords: Breast cancer, MDA, Vitamin E, A, Uric acid, Albumin, urea, creatinine.

Introduction

Breast cancer is the most widely recognized disease analyzed in women, representing more than 1 of every 10 new diseases diagnoses every year. It is the second most reason for death from malignancy among women in the world1. Breast cancer always advances reticently. A large portion of the patients finds their sickness amid their normal screening. Others fortuitously found a breast mass, change of breast shape or size, or areola discharge2. In any case, Physical examination, imaging particularly mammography, and tissue biopsy must be done to analyze breast malignancy. The survival rate enhances with the early conclusion. The tumor will in general spread lymphatically and hematologically distant metastasis and a poor forecast. This clarifies and stresses the significance of breast disease screening programs3. The danger of malignancy repeat diminishes by about half at 10 years, and the risk of breast cancer doom passing decreases by practically 20%. Radiation therapy is useful in extensive tumors (maximal to 5 cm) or if the tumor pervades skin or chest wall and if there are positive lymph nodes. Likewise, it tends to be utilized as a palliative treatment in cutting edge cases such if there is a focal sensory system (CNS) or bone metastasis. It tends to be conveyed as outside bar radiation, brachytherapy, or blend of both4,5. Antioxidants comprise the foremost vindication system that boundary the toxicity linked with free radicals Cells have advanced a comprehensive array from antioxidants that act cooperatively in vivo to battle the malicious impacts of free radicals. uric acid and Albumin have been important agents of antioxidants6. Roche et al., recently reviewed the antioxidant properties of serum albumin7. Vitamin E is a fat-soluble vitamin including eight homologues: four tocopherols (α-tocopherol (T), β-T, γ-T, δ-T) and four tocotrienols (α-tocotrienol (TT), β-TT, γ-TT, δ-TT). A-tocopherol, the central action of vitamin E with powerful antioxidant properties, can dispose of responsive oxygen species, prevent carcinogenesis and tumor growth, and stimulate cancer cell apoptosis4,9,10,11. Vitamin A is a fat-soluble vitamin that is also powerful antioxidant. It plays a critical role in maintaining healthy vision, neurological function, healthy skin, and many membranes. It is involved in reducing inflammation through fighting free radical damage. Consuming a diet high in antioxidants is a way to naturally slow aging12.
Material and Method

Sample Collection, Preparation, and Analytical Methods: This research was carried out in medical city complex, Baghdad, Iraq, and Baghdad teaching hospital, oncology teaching hospital. The complete physical examination was done to every patient during the period from October 2016 to January 2017. Thirty women new diagnosed with malignant breast cancer, with age ranging from 20 to 40 years. The final diagnosis was established by aspiration of cysts using (FNA) and mammography. Blood samples and biopsy from breast were taken from 30 women new diagnosis of malignant breast cancer and again take blood and biopsy after radiotherapy from the same women.Five milliliters of blood, of each individual of patients, were withdrawn from the vein. The blood sample was placed in a gel tube and allowed to clot on the bench for 20 min, then centrifuged at 3000×g for 10 min. The obtained serum was stored in a refrigerator at−20°C for subsequent. Serum levels of vitamins E and A were determined for each sample by HPLC technique. The samples were prepared for injection to the HPLC system. Added 200μl of serum to 100μl ethanol and incubated at room temperature for 10 minutes (to precipitate protein) followed by the addition of 400μl methanol and vortexed for 15 sec, to this mixture, 1.0 ml of hexane added (for extraction of fat) and vortexed for another 60 sec. The tube was centrifuged for 5 min at 3500 rpm at room temperature; the supernatant was transferred to a fresh tube (The hexane extraction step was repeated three times, 60 sec each time). Hexane was evaporated under nitrogen flow and the sediment was reconstituted in 350μl mobile phase and passed through target syringe polypropylene filters (4 mm, 0.45 μm) to remove the undisclosed particles. Chromatographic analysis was run by injecting the filtrate into the column through auto sampler using insert tube. Serum MDA (mg/dl), Uric acid (mg/dl),Albumin (g/dl),Urea and creatinine(mg/dl) levels using spectrophotometer according to the manufacturer’s instructions (Linear-Spain).

Immunohistochemical: According to the Dako (USA) 1- Deparaffinized by oven 60°C for one hour and three jars xylene for 5 min to each one 2- Hydrated by 100% 5 min ethanol 90% 5 min ethanol 70% ethanol 5 min and distel water 5 min 3- High-ph antigen retrieval was performed using high (pH 9.0) at 95°C in water bath for 40 min 4- After antigen retrieval finished cooling in room temperature for 20 min 5- Mark around the tissue with Pap pen to avoid spillage of the used liquid materials and to keep the reagent within a precise area. 6- Peroxide block was added to cover the sample and incubated for 10 min at humid chamber 7- Washing and incubation 3-5 min 8- Power block was added to cover the slide and incubated for 10 min in humid chamber 9- The slides didn’t washed just the slid was poured into filter paper 10- Primary antibody was added to cover the slides and incubated in humid chamber for 60 min 11- Washing and incubation 3-5 min 12- Linker was added and incubated in humid chamber for 20 min 13- H-BR secondary antibody was added and incubated in humid chamber for 30 min 14- Preparation the DAB chromogen by added 1 ml of substrate DAB and one drop of DAB chromogene and added to slide for 10 min 15- Washing and incubation 3-5 min Materials and Methods 45 16- Hematoxylin eosin (Myer’s) was added to cover the slides for 5 min 17- the slides washed with distel water for 5 min 18- Dehydration: immerse the slides in increasing alcohol concentrations, 2 minutes each (30%, 70%, 95%, then absolute alcohol). After that, put the slides in 2 changes of xylene, 2 minutes each. The slides covered with glass coverslips by using DPX and let them to dry at room temperature.

Statistical Analysis

Independent-Samples t test of the Statistical Package for Social Sciences (SPSS) program version 23.0. The resulting values were expressed as mean ± standard Error (SE). The statistical tests were considered to be significant at the p < 0.05 and highly significant at the p < 0.01.

Results

The detailed statistical of the obtained data containing mean ± standard Error, p values have been presented in Tables 1, 2 and 3. A significant higher difference in the serum levels of MDA reported between malignant (before radiotherapy) and radiotherapy (after radiotherapy) groups.

Table 1: MDA (mg/dl) for malignant and radiotherapy groups with breast cancer

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group 1 Malignant</td>
<td>Group 2 Radiotherapy</td>
</tr>
<tr>
<td>MDA (mg/dl)</td>
<td>Mean ± SE 5.5 ± 0.5</td>
<td>9.7 ± 0.6</td>
</tr>
</tbody>
</table>

*Group1: (before radiotherapy).
* Group2: Same group 1 (after radiotherapy).
A significant change of uric acid at (p<0.05) in comparison of radiotherapy group with the malignant group (p<0.05). A significantly lower level in albumin, Urea, and creatinine.

Table 2: Comparison of biochemical study for malignant and radiotherapy groups with breast cancer

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group 1 Malignant</td>
<td>Group 2 Radiotherapy</td>
</tr>
<tr>
<td>Uric acid (mg/dl) Mean ± SE</td>
<td>4.0 ± 0.2</td>
<td>2.8.0 ± 0.4</td>
</tr>
<tr>
<td>Albumin (g/dl)   Mean ± SE</td>
<td>3.8 ± 0.07</td>
<td>2.5 ± 0.2</td>
</tr>
<tr>
<td>Urea(mg/dl)      Mean ± SE</td>
<td>26.5 ± 1.0</td>
<td>30.2 ± 0.2</td>
</tr>
<tr>
<td>Creatinine (mg/dl) Mean ± SE</td>
<td>0.6 ± 0.02</td>
<td>0.8 ± 0.02</td>
</tr>
</tbody>
</table>

*Group1: (before radiotherapy).
* Group2: Same group 1 (after radiotherapy).

The result shows of serum vitamin (E and A) levels in the breast cancer patients. The reduction in the vitamin E level but a non-significant change than vitamin A, as seen in the table (3).

Table 3: Comparison of vitamins (E and A) for malignant and radiotherapy groups with breast cancer

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Groups</th>
<th>p-values</th>
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<tr>
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</tr>
<tr>
<td>Vitamin E (μg/dl) Mean ± SE</td>
<td>502.2 ± 31.3</td>
<td>460 ± 33.5</td>
</tr>
<tr>
<td>Vitamin A (μg/dl) Mean ± SE</td>
<td>52.2 ± 4.6</td>
<td>52.0 ± 4.4</td>
</tr>
</tbody>
</table>

*Group1: (before radiotherapy).* Group2: Same group 1 (after radiotherapy).

Discussion

Figure (1) has shown before radiotherapy (new diagnosis with malignant breast cancer), while figure (2) shown the same group 1 after radiotherapy.

Figure 1: Immunohistochemistry before radiotherapy.

Figure 2: Immunohistochemistry after radiotherapy.

The study performed by Kergonouand colleagues evaluated the effects of gamma radiotherapy on the lipid peroxidation MDA levels increased after radiotherapy (14) Studies show that increasing the MDA levels from radiotherapy can constitute cross connections.
with the first amino group of proteins or membrane phospholipids, leading to more strength of erythrocyte membranes\textsuperscript{14}. The rise of MDA in cancer has been shown to be associated with the body’s oxidative stress, which leads to the loss of polyunsaturated fatty acid (PUFA) in the plasma membrane and asserts that oxidative stress leads to dysfunction in the mitochondria and even regulates important factors such as the nuclear respiratory agent\textsuperscript{15}. Increasing in the per oxidation level of lipids in the serum of breast cancer patients when compared to the normal is consistent with some studies \textsuperscript{16}. In the case of radiation therapy, a significant increase is observed in MDA that radiotherapy increases oxidative stress of patients \textsuperscript{17}. It has been assumed that uric acid is considered as a strong antioxidant and protective agent, which may, therefore, protect against cancer by preventing the formation of oxygen radicals, which in turn protects against cancer occurrence \textsuperscript{18}. Many studies have shown a direct relationship between uric acid and cancer \textsuperscript{19}. Previous studies demonstrated that low serum albumin is an independent predictor of poor survival in several types of cancer including gastrointestinal cancer, lung cancer, ovarian cancer, nasopharyngeal carcinoma and breast cancer \textsuperscript{20,21}. In the case of radiation therapy, the reduction of albumin after radiotherapy was observed during exposure to radiation therapy. Free radicals produced a change in the structure and functions of the plasma proteins. It has been found that the changes caused by the radicals of albumin are associated with the damage of antioxidant properties and can lead to dramatic changes in protein stability \textsuperscript{16}. Steroid therapy is one of the factors that lead to the rise of urea, including contraceptive drugs, most of which contain estrogen and progesterin, women take long-term contraceptive pills are more likely develop breast cancer leads to the rise of steroid hormones followed by higher urea \textsuperscript{22}. The high creatinine is associated with the injury of several types of cancers, including prostate cancer that kidney inflammation, leads to high urea and creatinine levels \textsuperscript{23}. Our study differs from another study, where it was found that the level of creatinine is within the normal value \textsuperscript{24}. Evidence to date is insufficient to support taking vitamin E to prevent cancer. Patient compliance with vitamin E for radiation induced breast fibrosis appears to be worse in clinical practice compared with previously reported randomized trials \textsuperscript{25}. There are studies are in agreement with this study where there was a decrease in vitamin E in the use of radiation therapy \textsuperscript{26}. There are some studies showing the reduction of vitamin E in bone marrow and breast cancer during radiation therapy \textsuperscript{27}. These results are consistent with others \textsuperscript{26}. In order to minimize the negative signal of radiation therapy, there should be attention to diet and antioxidants. Previous results showed there is no relationship between vitamin E and the subsequent development of breast cancer \textsuperscript{28,29}. Cancer cells use antioxidants more effectively than normal cells and these results are consistent with Elango \textsuperscript{30} who reported significant reductions in the levels of vitamins A in cancer patients who received radiation therapy with those who did not receive radiation therapy in addition to its antioxidant role. It has been suggested that vitamin A improves blood flow, which promotes normal tissue oxygenation and renders the tumors susceptible to radiation \textsuperscript{31}. Other research has shown no connection between vitamin A concentration and subsequent development from breast cancer, a number of prospective studies have shown a significant negative relationship between serum nutrient A (retinol) concentrations and risk of cancer \textsuperscript{28}.

**Conflict of Interest:** There is no conflict of interest among the authors.

**Source of Funding:** Self

**Ethical Clearance:** This study is ethically approved by the Institutional ethical Committee.

**REFERENCES**


Effect of Ginseng Panax on the Histological Structure of the Liver and Kidney in Healthy Male Albino Rats

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ABSTRACT
This study was performed to investigate the histological effect by ginseng in the liver and kidney of male albino rats. The study was conducted on 30 rats. The animal was divided into 6 groups. The first group was given distilled water and used as a control group. The second and third groups were orally administered (3 and 5 mg/kg ginseng of body weight) for two weeks respectively. The fourth and fifth group were orally administered (3-5 mg/kg ginseng of body weight) for three weeks respectively. The sixth group were orally administered (3-5 mg/kg ginseng of body weight) for four weeks. Histological changes which observed in the liver were lost the nuclei (karyolysis) and degenerated and vacuolation of cytoplasm. In the kidney the change degenerated of epithelial cell and presence debris. The aim of this study effect of ginseng the change histology.

Keywords: Ginseng Panax, Histology, Liver, Kidney, Male, Albino, Rats

Introduction
Ginseng refers to eleven different varieties of a short, slow growing plant with fleshy roots. It has been used tonic and for treatment of various diseases. Ginseng has been processed to make white ginseng (air drying after harvest) and red ginseng (steaming or heat process). Lower blood sugar, and cholesterol levels, reduce stress, diabetes, and manage sexual days. Ginseng may help stimulate physical and mental activity in people who feel weak and tired. The energy boosting effect of ginseng were only in people currently undergoing treatment. The study says that demonstrate benefits for cognition, behavior, and quality of life, ginseng improve thinking processes, it is not possible at this stage to know whether the inclusion of ginseng in a food product. The pharmacological properties of ginseng are ginseng saponins called ginsenosides the major and bioactive constituents.

Materials and Method
Animals: Thirty rats were weighing between (300-325) grams were used in this study. The animals were maintained and acclimatized in the college of veterinary medicine –Tikrit university under laboratory conditions in group cages. The rats were collected randomly into six groups; group one was kept as control. It was administered orally with 0.1 ml of distilled water by gastric intubation daily for a month, group (2,3) was administered orally 3-5 mg/km ginseng for two week, group (4,5) was administered orally 3-5 mg-km ginseng for three week, group (6) was administered orally 3-5 mg –kg ginseng for four week.

Histology: At the day after the last dose killed the animals under intensive dose of chloroform. Liver, kidney of the animals was rapidly removed and micro dissected to obtain tissue samples for histological examination. immediately the tissues were fixed in 10% neutral buffered formalin, dehydrated with graded series of ethyl alcohol and embedded in paraffin. Sections of 5 microns were cut and stained with eosin and hematoxylin according to (7). By digital camera attached to light microscope were taking Photomicrographs of the slides.

Result
Group one: The control group
The kidney: the cortex of the kidney is formed by glomeruli, proximal and distal convoluted tubules, each glomerulus was formed by afferent and efferent arterioles and surrounded by Bowmanns capsule and the capsular space was present in between. The proximal convoluted tubules were many and lined by pyramidal cell with narrow lumen. The distal convoluted tubules were lined by simple cuboidal epithelial cell with wider lumen. The medulla of kidney was containing collecting ducts and tubules lined by cuboidal cell and the interstitial connective tissue had blood vessels, fibroblast and lymphocytes (fig 1).

The liver: The parenchyma of the liver, was formed by cords of liver cell, polygonal shape with central, spherical nuclei, surrounded by blood sinuses directed toward the central vein, Kupffer cell as phagocytic cell are present in the blood sinusoid. the portal areas were present in the parenchyma, each area was containing the branches of portal vein, hepatic artery and bile duct (Fig 2).

Group two:

The kidney: The cortex was containing hyper trophy of glomeruli with partial fragmentation. The proximal convoluted tubules were containing desquamated epithelial cell with glomerular filtrate in the lumen of these tubules. The medulla was highly infiltrated with lymphocytes and other write blood cell, the renal tubules were surrounded by degenerated epithelial cell with presence of debris of epithelial cell in certain tubules (Fig 3).

The liver: The parenchyma of liver was containing extensive degeneration of hepato cytes, certain number of them cell was lost their nuclei (karyolysis) also vacuolation of cytoplasm was noted, the portal area was containing congested blood vessels, surrounded by lymphocytic aggregation, also present around central vein. The kupffer cells also present in the blood sinusoid (Fig 4).

Group Three:

The kidney: The cortex was containing hyper trophy of glomeruli. The surface of these glomeruli was containing lymphocytic infiltration, also the epithelial cells of the proximal and distal convoluted tubules were hyper trophied, also certain tubules were containing cellular debris. The blood vessels were congested with blood. The medulla was present with renal tubules, demonstrated in well arechetictuve, its cell was simple cuboidal, surrounded by interstitial connective tissue (Fig 9,10). Blood sinuses with kupffer cell. The central vein in the center of lobules congested with blood with presence lymphocytic foci around these veins, also surrounding the branches of the hepatic artery, portal vein in the portal vein (Fig 5).

Group four:

The kidney: The cortex of kidney was containing hyper trophy of glomeruli and the convoluted tubules were loading with cellular debris in the center of the lumen of these proximal and distal convoluted tubules. Certain numbers of these tubules also have hyper. Trophy of epithelial cell. The medulla was containing renal tubules and ducts with thin segment of henele loops with norwed shape and size. The interstitial connective tissue was present with lymphocytic infiltration (Fig 6).

The liver: hypertrophy of the liver cell was demonstrated in the parenchyma of liver tissue, also certain cell was devoid for its nuclei, vacuolation of cytoplasm was detected in most liver cell, the blood sinusoids were rarely seen, due to hyper trophy of liver cell. Kupffer cell were present mostly near central vein, also pyilrotic nuclei were present in certain vacuolated cell, however blood sinusoid in certain places were dilated and appeared as cavalation with kupffer cell.

Group Five:

The Kidney: The cortex had proximal and distal convoluted with dis continuous lining of epithelial cell, mostly nearb capsules. The glomeruli were formed by afferent and efferent arteriole,surrounded by Bowmans capsule. The medulla was containing the renal tubules, duct and Henele loops with presence of congested blood vessel. With presence of heavy infiltration of lymphocyte interstitial connective tissue.

The liver: The parenchyma of the liver was demonstrated the sever congestion of the blood vessels, surrounded by hyper trophy of liver cell. The blood in the blood vessels was seen partially hemo lyzed. A small number of liver cell seen with vacuolated cytoplasm. The portal area had branches of portal vein, hepatic artery and bile duct which were surrounded by connective tissue and infiltrated with certain number of lymphocytes, these are also surrounded by hyper trophic hepatocytes.
**Group sex:**

**The Kidney:** The cortex of the kidney was containing glomeruli which seen normal structure and size. The proximal convoluted tubules were lined by pyramidal epithelial cell with narrow lumens, and the distal convoluted tubules were lined by simple cuboidal cell with wider lumens. The medulla was formed by multiple collecting and renal tubules, surrounded with interstitial connective tissue with many lymphocytes in between tubules. (Fig 7).

**The liver:** Hypertrophy of the liver cells were demonstrated with presence of kupffer cells in the blood sinusoids which appeared very narrow. The lymphocytes were demonstrated in between liver cell, the liver cells in certain places of parenchyma seen arranged in hony – comb pattern.

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**Fig. 1:** The cortex of kidney, glomeruli( arrow black). Proximal convoluted tubules (arrow blue). Distal convoluted tubules (arrow red). (H&E -40).

**Fig. 2:** Liver parenchyma, cords of polygonal liver cells (arrow black). Blood sinusoids (arrow blue ) with kupffer cells, central vein (arrow red ).(H&E -40).

**Fig. 3:** Hypertrophy of glomeruli(arrow black). With portial fragmentation (arrow blue ). desquamation of epithelial cell (arrow red) of proximal connective tissue. (H&E-40).

**Fig. 4:** Portal area of liver, congested portal vein (arrow black ), lymphocytic infiltration (arrow blue). vacuolation of liver cell(arrow red ).(H&E-40).
Fig. 5: Congestion of central vein (arrow black). Hypertrophy of liver cell (arrow blue). Lymphocytic diffusion (arrow red). (H&E-40).

Fig. 6: Hypertrophy of glomeruli (arrow black). Cellular debris (arrow blue). (H&E-40).

Fig. 7: Renal medulla, Renal tubules (arrow black). Interstitial connective tissue (arrow blue). (H&E-40).

Discussion

In this study the effect of panax ginseng documented to repair the damaged tissues of kidney, liver (8). On the other hand, constituents of herbal medicine including ginseng are considered toxic resulting in tissue damage (9). Inflammatory effect of ginseng has been responsible for the liver protection, ginseng suppressed the production of inflammatory cytokines, ginseng was found to inhibit tumor necrosis (10). Ginseng may have selectively inhibitory effect on CYP activities, in a recent animal study, ginsing was found to inhibit (alpha) pyrene induced CYP1A1 activation by down regulation of the gene expression (11), ginseng has interesting hepatoprotective. From atherapeutic stand point, ginseng alternative phyto-medicine and preventative therapy and treatment of liver diseases such as fatty liver and chronic hepatitis and in form of healthy foods (12). There is increasing attention to the effect of ginseng on the liver function, it is another important for further research and development to combine ginseng with other liver active drugs and pharmacological properties. (13).

Conflict of Interest: This research is a personal non-profit work and there is no conflict of interest.

Source of Funding: None.

Ethical Clearance: Ethical clearance was obtained from the Faculty Scientific Committee (Department of Biology, College of Education for Pure Sciences) to study the effect of ginseng panax on the histological structure of the liver and kidney in healthy male albino rats.

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Randomized Trial Comparing Efficacy between a Vaginal Misoprostol Loading and Non-Loading Dose Regimen for Second Trimester Pregnancy Termination

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ABSTRACT

Misoprostol is a (Prostaglandin) E1 is licensed for use in management of uterine evacuation. This study aimed to compare a vaginal misoprostol loading and non-loading dose regimen for second trimester pregnancy termination. Prospective randomized trial study done included 100 case with singleton nonviable pregnancy at (12-24 weeks) with specific criteria. Using cytotec (mesotac); loading dose misoprostol-tab of 800 µcg, maintenance dose 400 µcg every 6 hrs, non-loading 400 µcg dose both by vaginal route put deep in post Vaginal Fornix. Findings revealed that nausea was significantly higher in loading dose misoprostol-tab of 800 µcg. Approximately half of women in both groups needed analgesia. In conclusion, in using vaginal misoprostol, better efficacy is achieved within 24 hr in loading and non-loading doses.

Keywords: Missed abortion, misoprostol (loading, non-loading doses).

Introduction

Abortion is a taken word derived from a boriri mean miscarry, Abortion is defined as spontaneous or induce termination of pregnancy before viability (miscarry= abortion) are term used inter changeably now day – used the word… early pregnancy loss wastage or failure1,2.

Abortion become much less common by advancement of pregnancy. There after over all spontaneous loss in 2nd trimester is estimated 1-5% to 3% after 16 week. It’s only 1%. 1st trimester bleeding double the incidence of 2nd trimester loss. 2nd trimester abortion constitute 10-15% of all induced abortion would wide but are responsible for 2/3 of major abortion complication 3,4.

Management of 2nd trimester Abortion: Various management protocols have been used for second trimester pregnancy termination, these includes: surgical technique (dilatation and evacuation) and medical approaches such as intra-amniotic prostaglandin F2alpha instillation, prostaglandin E2 vaginal suppositories, Prostaglandin E1 and high dose oxytocin 2.

Both counseling and management of abortion should be provided without undue delay, woman should be free to choose, to be counseled alone or with a partner, friend or parent 10. Pre abortion counseling involving help her how to choose the way of termination.

Management options fall into 3 groups medical, surgical or expectant and there are many factors to be taken into account when discussing these options with patients such as gestation at which miscarriage is diagnosed, available facilities, Medical history, hemorrhage, patient choice and the cost.

Misoprostol, (Cytotec) Mesotac: Is a synthetic PG E1 analogues approved by FDA with aim of prevention & development of peptic ulcer. It was 1st used in Brazil 1988 for abortion purpose after which uses for 1st & 2nd trimester pregnancy abortion. It is a safe drug, inexpensive, stable at room temp and currently it is commonly used for medical abortion, cervix ripping, management of miscarriage, induction of labour and management of PPH.
It can give orally, vaginal, sublingual, buccal or rectally. However vaginal route is associated with slower peak level achievement but the effect lasts longer with fewer side effects. It can give orally, vaginal, sublingual, buccal or rectally. However vaginal route is associated with slower peak level achievement but the effect lasts longer with fewer side effects. It is safe but can cause teratogenic effect if the fetus alive.7

There is a large range of effective misoprostol dosing, ranging from 100 to 800 mcg for an individual dose and using various schedules, including regimens with loading doses.8 However, higher doses are generally more effective when misoprostol is used alone. The effect of misoprostol on uterine contractility was well studied by Gemzell-Danielsson et al.9 and Aronsson et al.10. To produce regular contractions, however, a sustained plasma level of misoprostol is required and this requires repeated oral doses. Furthermore, some Side effects and complications could associated with the use of misoprostol which are listed in literatures however, serious complications are rarely developed.6,11,12

**Patients And Method**

This is a prospective randomized trial study done in AL-Zahraa Maternity and Pediatric –Teaching Hospital from 20th of April to 20th of October 2016, involve 100 case with singleton nonviable pregnancy at (12-24 weeks) with specific criteria. Following thorough history and examination, each patient had 2 ultrasonography examination. Patients were excluded if she had multiple pregnancy scared uterus, and medical diseases such as cardiac or bleeding disorder.

The patients were randomized into two Groups:

**First group** (51 patients) was arranged to receive vaginal loading protocol of Misoprostol (misotac) (Sigma pharmaceutical Industries, Fizer each tablet contains 200mcg) 200 microgram every 6hours up to 4 doses per day, if there was no response the regime repeated in the next day. The misoprostol tablet was placed in the posterior fornix of the vagina.

At time of placement of subsequent doses, any remaining undissolved tablets were removed before next tablet was inserted. All patients were followed in the ward every 4 hours with observation of pulse rate, blood pressure, temperature and occurrence of side effects, in the ward provide analgesia antiemetic, other medication, before next dose given uterine contractions and cervical status were assessed by abdominal and vaginal examination, no additional misoprostol dose was repeated if abortion is imminent (patient had at least 70% cervical effacement with 2cm opening).

The induction considered to be started when the patient received the first dose of misoprostol and abortion defined as the time when the fetus was expelled (incomplete abortion) although in some cases placenta delivered at the same time (complete abortion) After abortion ultrasonography examination was done to confirm that the products of gestation (fetus and placenta) had been successfully removed to establish that the abortion was complete. Any retained products of the placenta (not delivered spontaneously one hour after delivery of the fetus) were removed by soft sponging. In this study, failure of induction is considered if the patient did not abort within 48hours. Following the procedure women were kept in hospital for eight hours, and advised for follow up visit after 10 days.

**Statistical analysis** performed using the statistical package for social sciences (SPSS) and the statistical tests and procedures were applied accordingly. P-value of ≤ 0.05 was considered statistically significant.

**Findings**

In table 1 there is no significant association between parity and gestational age for women under study, (P>0.05). Table 2 shows no significant difference between the two groups regarding complications except nausea was significantly more frequent in the loading group (regime 1). Furthermore, approximately half of women under both regimes need analgesia. There is no significant association between parity and time of success in the two regimes, (Table 3). The overall success rate was 82.9% and 80.4% in group 1 and 2, respectively, (Figure 1).
### Table 1: Distribution of cases according to gestational age and parity

<table>
<thead>
<tr>
<th>Gestational age/weeks</th>
<th>Parity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primi</td>
<td>Multi</td>
</tr>
<tr>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>16 - 12</td>
<td>24</td>
<td>49.0</td>
</tr>
<tr>
<td>17 - 20</td>
<td>15</td>
<td>46.9</td>
</tr>
<tr>
<td>21 - 24</td>
<td>10</td>
<td>52.6</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>49.0</td>
</tr>
</tbody>
</table>

P. value = 0.924 not significant

### Table 2: Relative risk of occurrence of complications in regime 1 compared to regime 2.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Regime 1 (n=49)</th>
<th>Regime 2 (n=51)</th>
<th>RR (95% CI)</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomiting</td>
<td>5</td>
<td>2</td>
<td>2.602</td>
<td>0.218</td>
</tr>
<tr>
<td></td>
<td>(0.469-19.128)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td>13</td>
<td>1</td>
<td>13.53</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>(2.03-276.68)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal cramp</td>
<td>8</td>
<td>12</td>
<td>0.694</td>
<td>0.368</td>
</tr>
<tr>
<td></td>
<td>(0.27-1.67)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td>2</td>
<td>1</td>
<td>2.08</td>
<td>0.534</td>
</tr>
<tr>
<td></td>
<td>(0.151-57.81)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fever</td>
<td>2</td>
<td>4</td>
<td>0.52</td>
<td>0.428</td>
</tr>
<tr>
<td></td>
<td>(0.1-2.714)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhea</td>
<td>6</td>
<td>9</td>
<td>1.24</td>
<td>0.697</td>
</tr>
<tr>
<td></td>
<td>(0.407-3.82)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need analgesia</td>
<td>27</td>
<td>21</td>
<td>1.33</td>
<td>0.164</td>
</tr>
<tr>
<td></td>
<td>(0.88-2.02)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>1</td>
<td>0</td>
<td>0.98</td>
<td>0.305</td>
</tr>
<tr>
<td></td>
<td>(0.941-1.02)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure</td>
<td>7</td>
<td>10</td>
<td>0.87</td>
<td>0.761</td>
</tr>
<tr>
<td></td>
<td>(0.31-2.31)</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

RR: relative risk, CI: confidence interval

### Table 3: Association between parity and time of success

<table>
<thead>
<tr>
<th></th>
<th>Regime 1 (n=49)</th>
<th>Regime 2 (n=51)</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success within 24hr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primigravidae</td>
<td>18/24(75%)</td>
<td>17/25(68%)</td>
<td>0.588</td>
</tr>
<tr>
<td>Multigravidae</td>
<td>19/25(76%)</td>
<td>18/26(69.2%)</td>
<td>0.598</td>
</tr>
<tr>
<td>Whole group</td>
<td>37/49(75.5%)</td>
<td>35/51(68.6%)</td>
<td>0.443</td>
</tr>
<tr>
<td>Success in 48hr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primigravidae</td>
<td>2/24(8.3%)</td>
<td>2/25(8%)</td>
<td>0.966</td>
</tr>
<tr>
<td>Multigravidae</td>
<td>3/25(12%)</td>
<td>4/26(15.4%)</td>
<td>0.725</td>
</tr>
<tr>
<td>Whole group</td>
<td>5/49(10.2%)</td>
<td>6/26(11.7%)</td>
<td>0.803</td>
</tr>
<tr>
<td>Failure rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primigravidae</td>
<td>4/24(16.7%)</td>
<td>6/25(24%)</td>
<td>0.524</td>
</tr>
<tr>
<td>Multigravidae</td>
<td>3/25(12%)</td>
<td>4/26(15.4%)</td>
<td>0.725</td>
</tr>
<tr>
<td>Whole group</td>
<td>7/49(14.3%)</td>
<td>10/51(19.6%)</td>
<td>0.479</td>
</tr>
</tbody>
</table>
Discussion

Misoprostol is an effective drug for termination of pregnancy in the second trimester for fetal death or other indication for termination of pregnancy. Various regimens of misoprostol use in terms of route, dosage, and interval have been tested between doses to determine the optimal application. A lot of previous studies suggested that vaginal administration of misoprostol is more effective than other routes of administrations for second trimester pregnancy termination.

Other researchers used regimen of vaginal or sublingual misoprostol (400 µg) every 3 hours for up to five doses. They recommended that particularly for nulliparous women, vaginal administration of misoprostol is more effective than sublingual dosing. However, in our study, there was no significant association between parity and gestational age for studied women. The two groups did not differ significantly with respect to side-effects of complications except that nausea was reported in higher percentage (P<0.001) in women under regime 1 (26.5%) than that under regime 2 (19.9%). However, in both groups, 27 (55.1%) and 21 (41.1%) women in regime 1 and regime 2 need analgesia respectively. A systematic review published in 2011 suggested that a variety of analgesic options should be made available to women of second trimester terminations. In the present study, we found that medical termination of pregnancy using loading dose of vaginal misoprostol was 75.5 % success within 24hr and 10.2% success within 48hr in one hand. In other hand, non-loading dose of vaginal misoprostol was 68.6 % and 11.7% success within 24hr and success within 48hr respectively. Thus, these results indicate that, using vaginal misoprostol, better efficacy is achieved within 24hr. No significant associations between parity and time of success in the two regimes, agreement with Bhattacharyya et al in their a prospective, randomized, controlled trial study were undertaken 138 women at 14–20 weeks gestation and used two regimens of vaginal misoprostol in second trimester termination of pregnancy. Their subjects were randomized to receive either regime A: 400 µg of intravaginal misoprostol every 3 h, or regime B: loading dose of 600 µg, followed by 200 µg every 3 h. They were found that there was no significant difference in the success rates at 24 and 48 h (Regime A: 97.18 and 98.59%; Regime B: 95.45 and 95.45%), and in mean induction-abortion interval (12.97 versus 12.13 h). However, mean misoprostol requirement was significantly higher for Regime A (1701.4 versus 1269.7 µg). The incidence of fever was significantly less in Regime B (32.4 versus 14.9%). They concluded that use of vaginal misoprostol for second trimester abortion had comparable efficacy with less drug requirement for the 600 µg loading dose followed by 200 µg 3-hourly regime compared to the 400 µg 3-hourly regime. In this study 800 µg loading dose and 400 µg maintenance dose and non-loading start with 400 µg, only gastrointestinal disorder (nausea) more in loading dose, this mean short interval low dose associated with less side effect and better efficacy.

Also this study agreed with Chaudhuri et al findings that compared 185 women who given 400 µg vaginal misoprostol either every 6 h (group 1) or every 12 hours (group 2) for a maximum of four doses. The mean induction abortion interval in group 1 (12.59 h) was significantly shorter (P < 0.001) than that in the group 2 (16.41 h). The percentage of women who achieved successful abortion within 12 h in group 1 (56.52%) was also significantly higher (P = 0.00005) than that in group 2 (25.80%). The incidence of side-effects was comparable and not clinically serious. This mean interval between doses most important than the dose itself in termination of pregnancy, this agreement with our study (6 hr. interval better than 12 hr.) If we compare our study with Koh et al how is compared women who received misoprostol 400 µcg (n = 40), misoprostol 200 µcg (n = 37) or gemeprost 1 µcg (n = 39) which was administered vaginally at 4 hour intervals up to five doses or until termination of pregnancy (TOP) occurred. They found that the misoprostol 400 µcg group had the highest incidence of successful TOPs (92.5%) compared to the misoprostol 200 µcg (70.3%; P = 0.017).
misoprostol 400 µcg group had the highest incidence of fever (70.0%) compared to misoprostol 200 µcg (24.3%; P < 0.001) we found the dose also important but high dose associated with more side effect also agreement with our study. A recent study carried out by Pongsatha and Tongsong, concluded that misoprostol in a dose of 400 µcg every 6 h, either with a loading dose or non-loading dose, and was comparable in terms of abortion/delivery time. Higher maternal effects, but with no significant deference between two groups in successful rate in 24 hr. or 48 hr. but more side effect GIT, fever and chills, were found in the loading dose regimen in our study we found nausea is more significant.

Conclusions

Misoprostol in a dose of 400 µcg every 6 hr either (Loading dose 800 µcg) or non-loading dose of 400 µcg every 6 hr. was comparable in terms of abortion 2nd trimester. Higher maternal effect, such as fever or nausea & GIT disorder were found in the loading regimen. Therefore, based on the present study. We recommend the non-loading regimen for 2nd trimester pregnancy termination.

Ethical Clearance: All ethical issues approved and signed informed consents obtained from all participants

Source of Funding: self-funded

Conflict of Interest: None

REFERENCES


Early Detection of Acute Kidney Injury by Measurement of Serum Cystatin C level in ICU Traumatized Patients

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ABSTRACT

Background: Acute injury of the kidney is characterized by a rapid decrease in the speed of glomerular filtration (GF). The development of acute kidney injury (AKI) is associated with a large number of medical complications. Cystatin C can be used as a better biomarker of the glomerular filtration rate than serum creatinine and it can be used for an early diagnosis of any ongoing deterioration in the function of kidneys and monitoring the effectiveness of the recommended treatment.

Objective: To assess the serum cystatin C level in ICU patients who developed AKI secondary to major trauma.

Patients and Method: A prospective cross sectional study conducted over 190 patients (100 healthy subjects as control group and 90 AKI patients as case group) with different age and gender was included in this study. Blood samples for serum Cys C, SCr, B.urea were collected within the first 24 hrs of onset of injury.

Results: The mean age of the AKI group was (37.3 ± 12.8) years, for control group (34.9 ± 11.5), with high significant association were found between B. urea, S. creatinine, and S. cystatin C. Correlation coefficient between serum Cystatin C- based GFR and serum creatinine - based GFR revealed more negative correlation in Cystatin C- than S. creatinine, this mean that serum Cystatin C-based GFR reflects a decline in GFR with worsening AKI in a much better way than creatinine–based GFR.

Conclusion: Detection of serum cystatin C in early AKI is more precise than serum creatinine detection.

Keywords: Acute kidney injury, Cystatin C, S. creatinine, Intensive care unit

Introduction

Acute kidney injury (AKI) is characterized by a rapid decrease in the speed of glomerular filtration (GF), disorders in acid-base and electrolyte homeostasis and disability to excrete nitrogen products by the kidney. The development of AKI is associated with a large number of medical complications. (¹)

The diagnosis of AKI is based on the determination of serum creatinine and creatinine clearance which are insensitive tests in the early stages of AKI. With these parameters, the RIFLE criteria were established (Risk, Injury, Failure, Loss, and Kidney End-Stage Disease). AKIN (Acute Kidney Injury Network) and KDIGO (Kidney Disease Improving Global Outcomes) are another criteria that allowed a homogenization in the diagnosis of this disease (²,³) Major trauma can be complicated with acute kidney injury (AKI) that considered as independent risk factor increasing the mortality and morbidity rate of patient with ICU admission (⁴).

Early recognition and treatment of such a complication is important to improve the short and long –term outcomes in this group of patients. (⁵)

In critical care patients, the management of AKI is based on early identification of renal failure, supportive measures, overcome ongoing and prevent further or recurrent injury to the kidney (⁶), avoid massive blood transfusion(⁷)(unless it’s necessary) and preclude any nephrotoxic medications. (⁸)
Risk factors for development of AKI in patient with major trauma are major surgical operations, hypovolemic shock due to certain causes, rhabdomyolysis (9,10) and massive blood transfusion (7) Other risk factors including elderly patient presence of medical comorbidity, and diabetes mellitus (11,12).

The monitoring of the patient urine output, blood urea and serum creatinine are non-specific & late biomarkers for an early detection of evolving renal impairment, prevention early recognition and treatment of any injury to the kidney. This increase the interest the use of AKI – specific biomarker to preclude this issue. Cystatin C is a 13 kilo Dalton proteinase inhibitor from the cystatin super family of cysteine protease inhibitors. It’s produced by all of the body cells, that contain nucleus and it has a significant role in the catabolism of the proteins inside the cells. Cystatin C can be found in variety of body fluid as blood and filtered through the kidneys. Cystatin C can be used as a better biomarker of the glomerular filtration rate than serum creatinine, and can be used for an early diagnosis of any ongoing deterioration in kidney function, and improving AKI definition. (13, 14)

By this way, the limitation of measurement of creatinine clearance, that relate to the patient’s muscle mass, the patient’s general health status, dietary protein and physical exercise, can be overcome. (15)

There is globally increase in the acute kidney injury incidence particularly in intensive care units (18-73%). While for the mortality rates of AKI patients admitted to the ICU range from (20-47%) and reach to over 50% in patients need for renal replacement therapy. This needs clinicians to be ready for rapid diagnosis and early management of the disease (AKI) in the ICU, as the early and accurate detection of AKI is essential to prevent disease progression, and possibly improves outcome. (16). The changes in S. Cr occur with a delay after the AKI has been sustained, and recent research has focused on novel biomarkers for the early detection of AKI to facilitate early intervention. (17, 18) Cystatin C (CysC) is a low-molecular-weight protein of 13 kD produced by all nucleated cells. It is freely filtered by the glomerulus, reabsorbed, and catabolized, but it is not secreted by the tubules. (19)

**Aim of the Study:** To assess the serum cystatin C level in traumatized patients with AKI admitted to the ICU.

**Patients and Method**

A prospective cross sectional study conducted in Al-Hussain hospital/Samawa city/Iraq, for about 2 years duration (from first of September 2016 to the end of August 2018) when two groups of respondents with different age and gender were included in this study (case group with 90 AKI patients, and control group with 100 healthy subjects).

All patients gave their consent to participate in this study in agreement with the Helsinki Declaration. Demographic information was collected including age, gender, dates and source of admission. All patients were submitted to full clinical assessment including history taking, thorough clinical examination and laboratory investigations.

Regarding AKI group, traumatized patients in ICU were considered to have AKI if S. Cr had increased above baseline by at least 0.3 mg/dL or 50% according to the definition of the AKIN. (20) Sustained AKI was defined by an increase in S. Cr of at least 50% from baseline for 24 hours or longer as specified by the RIFLE criteria. (21) Blood samples for serum Cys C, S.Cr, B.urea were collected within the first 24 hrs of onset of injury.

**Statistical Analysis**

After the entering of data in a table devised by the researcher, the analysis was carried out statistic with the SPSS program, version 24. For qualitative variables, we used frequencies and percentages, and for the quantitative variables, we used measures of central tendency (median, media and fashion) and dispersion (standard deviation). Receiver operator curve were used to measure the validity test.

Logistic regression was done for estimated GFR (eGFR) by measuring the 2 biomarkers (S. CysC and S.cr) in AKI patients.

For the inferential statistics the tests were used of chi-square test (with a significance of ≤5%).

**Results**

The current study included two groups: acute kidney injury group (n=90) and healthy group (n=100). The mean age of the AKI group was (37.3 ± 12.8) years while for
control group was (34.9 ± 11.5) years, with no statistically significant differences between them Furthermore, no significant association between both groups (case & control) regarding the weight, while highly significant association were found regarding B. urea, S crea tinine, and S. cystatin C (table 1). Gender distribution of the respondents show that the majorities were male (72 for AKI group and 73 for healthy group) and female was (18 for AKI group and 27 for healthy control group (figure 1).

Table 1: Age, weight and biochemical characteristics of the study group

<table>
<thead>
<tr>
<th>Domain</th>
<th>AKI group (n = 90)</th>
<th>Healthy group (n = 100)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>37.3 ± 12.8</td>
<td>34.9 ± 11.5</td>
<td>0.1 NS</td>
</tr>
<tr>
<td>Weight/kg</td>
<td>74.4 ± 6.7</td>
<td>74.1 ± 5.4</td>
<td>0.7 NS</td>
</tr>
<tr>
<td>B.urea</td>
<td>57.2 ± 22.1</td>
<td>31.6 ± 5.8</td>
<td>&lt;0.001 HS</td>
</tr>
<tr>
<td>S.creatinine</td>
<td>2.13 ± 1.3</td>
<td>0.87 ± 0.21</td>
<td>&lt;0.001 HS</td>
</tr>
<tr>
<td>S. cystatin C</td>
<td>1.91 ± 1.03</td>
<td>0.79 ± 0.04</td>
<td>&lt;0.001 HS</td>
</tr>
</tbody>
</table>

NS=Not significant, HS =Highly significant

Table 2: correlation between S. creatinine and S. cystatin C

<table>
<thead>
<tr>
<th>Variables</th>
<th>Acute kidney injury (patients group) (n = 90)</th>
<th>Healthy group (n = 150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. creatinine</td>
<td>2.13 ± 1.1</td>
<td>0.97 ± 0.21</td>
</tr>
<tr>
<td>S. cystatin C</td>
<td>1.75 ± 1.03</td>
<td>0.72 ± .04</td>
</tr>
<tr>
<td>Pearson correlation coefficient</td>
<td>0.713</td>
<td>0.353</td>
</tr>
<tr>
<td>P value</td>
<td>0.01</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Correlation</td>
<td>Significant association</td>
<td>Highly significant association</td>
</tr>
</tbody>
</table>

Regarding to the distribution of the S.cr and S. Cys C in acute kidney injury patients, it was found that less than 2/3rd (60%) of the patients (54 patients) was with normal level of S.cr and (40%) (36 patients) with abnormal level of the S.cr, while all patients had abnormal level of S.Cys C (figure 2).

Table 3: Validity test of the cys c to measure AKI

<table>
<thead>
<tr>
<th>Cutoff value</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 mg/dl</td>
<td>90.2</td>
<td>88.0</td>
<td>97.0</td>
<td>81</td>
<td>89.1</td>
</tr>
</tbody>
</table>
As shown in table 4 the correlation between both biomarkers in patients with AKI, we found that both markers-based GFR have a negative correlation, with more negative (-0.00724) in serum CysC than that (-0.00331) in serum creatinine-based GFR.

Table 4: Multiple logistic regression for eGFR by measuring serum creatinine and cystatin C in patients with AKI

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variables</th>
<th>R</th>
<th>Coefficient</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AKI</td>
<td>GFR (CysC)</td>
<td>0.825</td>
<td>1.221</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>GFR (Cr.)</td>
<td></td>
<td>-0.00724</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0.00331</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

**Discussion**

AKI is one of the commonest diseases admitted to the ICU patients; with a mortality rate vary from 30% to the 90% (22,23). The early and precise detection of AKI is essential to prevent disease progression, and thereby, to possibly improve its effect (24,25).

The production of the biomarker (Cystatin C) is stable in the body and not affected by renal situations, or increased catabolism of protein or dietetic factors. Furthermore, it is not like creatinine which is changed with age or muscle mass. The current study revealed that there is highly significant increase in B.urea, S.CysC and S.cr in AKI (patients) group than that in control (health) group. Paolo L et al, and other researchers have revealed that serum CysC is a more precise marker of GFR than SCR especially in children with chronic kidney disease (26-28). So we can reasonably hypothesize that acute
change in CysC might be more precise in detection of acute GFR reduction than S.cr does. This is in agreement with the present study when the correlation coefficient between serum CysC-based GFR and serum creatinine-based GFR is more negative correlation in first marker than the 2nd one, which is mean that serum CysC-based GFR reflects a decline in GFR with worsening AKI in a much better way than serum creatinine-based GFR. Therefore, in the AKI group, GFR-based cystatin C was better than creatinine-based GFR for the early detection of the worsening clinical state. This suggests the utility of Cystatin C serum on serum creatinine in early prediction of decreased GFR and therefore aids in early therapeutics intervention.

**Conclusion**

Early detection of serum cystatin C in early AKI is more precise than serum creatinine detection.

**Conflict of Interest:** There is no conflict of interest by the authors

**Source of Funding:** Self

**Ethical Clearance:** Taken from the scientific committee of the Iraqi Ministry of health

**REFERENCES**


ABSTRACT

Myrrha and Sage extract solutions are promising prophylactic and disinfectant agents against microorganisms, suggesting that these solutions might be useful as antimicrobial topical solutions for dental contamination. Three different concentrations of Myrrha and Sage extract solutions 2%, 5% and 10% were separately exposed to the Candida albicans and chlorohexidine solution that used as control to treat the PMMA and Flexible Acrylic plates, the percentage of colonies reductions were calculated. In case of using Sage extract solutions, the colonies reductions were 60.90%, 84.10% and 90.63% respectively for PMMA plates compared with 98.56% reduction for chlorohexidine with mean p-value (0.0028).

As regard Myrrha extract solutions, the colonies reductions for PMMA plates were 76.28%, 82.25% and 88.25% respectively, compared with 93.88% of reduction for chlorohexidine with mean p-value (0.0008).

This research considers both Myrrha and Sage extract solutions of different plants are promising solutions and capable of using as alternative solutions in treating Candida albicans in either PMMA and Flexible Acrylic plates.

Keywords: Poly methyl methacrylate [PMMA], Flexible Acrylic, Salvia officinalis (Sage) and Commiphora myrrha (Myrrha)

Introduction

Fungal diseases currently represent global challenges. For instance, infection of various crops (2), certain bats (3), and many amphibians (4) have become under severe and potentially existential stress due to attacks from fungal microorganism. The impact of fungal disease on human health has also been raising, in particular because of the growing number of immunocompromised cases of patients resulting from the AIDS epidemic, increased organ transplantation and cancer chemotherapy, and widespread antibiotic use that impacts on the human microbe. Candida species, especially Candida albicans, represent a major component of the disease burden caused by fungi and are the fourth most common cause of nosocomial infections in North American hospitals (5). Although Candida albicans is the most causing of candidemia, it has been a decrease in the incidence and an increased isolation of non-albicans species of Candida in late years (6). Preventive measures include maintaining a good oral hygiene, keeping a healthy lifestyle including good nutrition, the careful use of the antibiotics, treatment of infected areas and must keeping skin dry and clean, free from open wounds.

Some Plant extracts are used in last decades as prophylactic and disinfectant agents against bacterial and fungal organisms, and it was recommended as antimicroorganisms. Replacing the requirements in current time to the antibiotics or anti fungal drugs. Denture composition are made of either thermally activated poly-methyl methacrylate Acrylic [PMMA] or flexible acrylic which is composed of thermoplastic flexible...
polymer. The suggested solutions of plant extract are derived here of different plants: *Salvia officinalis and Commiphora myrrha*. *Salvia officinalis* has numerous common names. Some of the best-known names are Sage, it has been used since ancient times as a diuretic, a local anesthetic for the skin, and for other uses.

*Commiphora myrrha* or called as Myrrha has also been recommended as an analgesic for toothaches and can be used in liniments for bruises, aches, and sprains. Myrrh is a common ingredient of tooth powders. Myrrh and borax in tincture can be used as a mouth-wash. A compound tincture, or horse tincture, using myrrh is used in veterinary practice for healing wounds.

The purpose of this study is to evaluate the antimicrobial activity of *Salvia officinalis* and *Commifora myrrha* extract solutions on Poly Methyl Methacrylate Acrylic [PMMA] and flexible Acrylic dental materials which contaminated with high resistant microbe of *Candida albicans* compared to normal antibiotics.

**Material and Method**

**Preparation of Samples:** The Sage and Myrrha powders were purchased from formal Iraqi agriculture market. Then were prepared 2%, 5% and 10% by dissolving 2 gm, 5 gm and 10 gm respectively of each above one in 100 mL of D.W then vortex until complete dissolving and left in 4 °C after filtrations by (milliporefilter 40µmiter).

**Preparation and construction of Poly Methyl Metha Acrylate (PMMA) plates:** According to references, acrylic plates are constructed as bellow from the poly methyl methacrylate [PMMA], which are supplied in form of powder (polymer) and liquid (monomer).

**Preparation and construction of Flexible acrylic plates:** Flexible acrylic resin is a thermoplastic flexible polymer composition offered for use in a wide range of applications, one of them is the fabrication of removable dental prosthesis.

**Growing of Microorganisms:** *Candida albicans* was grown first on the PDA broth and incubated over night in the 40 specimen containers which divided into (20) containers for PMMA plates and other (20) containers for Acrylic plates.

**Exposing Samples on Microorganism:** The antimicrobial activity was determined in the following steps, after incubating the microorganism over night, 0.5 mL from each tube was taken and put in the Eppendorf tube (Before treatment). After that, the media was discarded from all tubes and added 4 mL from Sage, Myrrha, D.W and Chloro hydroxyl as usual control with different concentrations and left it for 30 minutes with mixing at each 2 minutes. After the standing time, the tubes were rinsed with D.W and then addition 4 mL from D.W for each tube and stand for 2 minutes. After that, 0.5 mL from each tube was taken and put it on the Eppendorf tube.

**The Efficiency of Samples on Microorganisms:** PDB (Potato dextrose broth) media was used to grow the *Candida albicans*. Specific dilution was used in this experiment, D.W : Stock as (1000:1) was prepared from each tube then 50 µL form each dilution was taken and spread on the media using L. Shape loop, and then incubate for 12-20 hrs for determining the efficiency of samples on microorganisms.

**Inhibition Percentage:** The inhibition percentage of each different sample was calculated according to the comparison between (Non-treated with Candida) and (treated with Candida) via calculating the colonies that formed in Petri-dishes.

**FTR measurements:**

Using Fourier Transform Infrared (FTIR) Spectroscopy Processing technique: The raw data resulted of Sage extract and Myrrha solutions were converted by this technique to the desired result: The sample’s spectrum (output of light) as a function of infrared wave length or equivalently wave number was measured. (Figure 5).

**Results and Discussion**

Plant extracts are promising prophylactic and disinfectant agents against mico-organisms due to its natural organic and safety, suggesting that these extracts might be useful as antimicrobial agent and disinfectant solution for dental prosthesis. Dental plates that made of either thermally activated poly methyl methacrylate acrylic [PMMA] or flexible acrylic which is thermoplastic flexible polymer composition, these materials are widely used in construction of removable dental prosthesis and some maxillofacial prosthesis.

In figure (1 and 2) Showed the number of colonies and percentage of colonies reductions by using chlorohexidine 2% solution as control and the following Sage extract solutions 2%, 5% and 10%, that were...
seperately treated the PMMA plates exposed to the *Candida albicans*.

In Sage extract solutions, the colonies reductions were 60.90%, 84.10% and 90.63% respectively for PMMA plates compared with 98.56% reduction for chlorohexidine, with mean p-value (0.0028). On the other hand, the Myrrah extract solutions 2%, 5% and 10% exposed to Flexible Acrylic, the colonies reductions were 76.28%, 82.25%, 88.25% respectively, compared with 93.88% reduction for chlorohexidine with mean value (0.0008) as shown in (figure 3 and 4).

![Figure 1: Showing colonies growth number as mentioned in Petri dishes (A) Table (B) and Draft (C). Colonies were grown on PDA agar that previously and seperately treated with Sage extract solutions on the PMMA plates. Colonies growth were tested by using Chlorohexidine 2% solution as control and the following Sage extract solutions 2%, 5% and 10%](image)

![Figure 2: Showing the percentage of colonies reductions as mentioned in Table (A) and Draft (B)](image)

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Treated Mean</th>
<th>Non-Treated Chlorohexidine 98.56</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td>60.90</td>
<td>98.56</td>
</tr>
<tr>
<td>5%</td>
<td>84.10</td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>90.63</td>
<td></td>
</tr>
<tr>
<td>P value</td>
<td>0.0010</td>
<td>0.0008</td>
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<tr>
<td>Significant different</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Concentrations</td>
<td>Treated Number of Colonies</td>
<td>Non-Treated Number of colonies</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>2%</td>
<td>75</td>
<td>320</td>
</tr>
<tr>
<td>5%</td>
<td>63</td>
<td>350</td>
</tr>
<tr>
<td>10%</td>
<td>36</td>
<td>300</td>
</tr>
<tr>
<td>Chlorohexidine</td>
<td>22</td>
<td>352</td>
</tr>
</tbody>
</table>

Figure 3: Showing the colonies growth number as mentioned in Petri dishes (A) Table (B) and Draft (C)

Colonies were grown on PDA agar that previously and separately treated with Myrrah extract solutions on the PMMA plates. Colonies growth were tested by using Chlorohexidine 2% solution as control and the following Sage extract solutions 2%, 5% and 10%.

![Figure 3](image.png)

<table>
<thead>
<tr>
<th>Concentration</th>
<th>2%</th>
<th>5%</th>
<th>10%</th>
<th>Chlorohexidine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>76.28</td>
<td>82.25</td>
<td>88.25</td>
<td>93.88</td>
</tr>
<tr>
<td>P value</td>
<td>0.0023</td>
<td>0.0019</td>
<td>0.4387</td>
<td>0.0008</td>
</tr>
<tr>
<td>Significant different</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 4: Showing the percentage of colonies reductions as mentioned in Table (A) and Draft (B)

Colonies were grown on PDA agar that previously and separately treated with Myrrah extract solutions on the PMMA plates. Colonies growth were tested by using Chlorohexidine 2% solution as control and the following Sage extract solutions 2%, 5% and 10%.

![Figure 4](image.png)

Figure 5: FTRI diagrams showing the spectrum range of (A) Myrrah (B) Sage, Reflecting compounds by reading the wave lengths

In the previous study, C. albicans was discovered in 60% of lesions with proximal caries and 100% of the cervical caries samples were candida albicans positive in the samples taken from the plaque of 15% of the cases without and with caries and with c, 20% of the dental plaque of ECC children with proximal caries and 80% of them with cervical caries \(^{(12)}\).

Although, \(^{(11)}\) referred that 52% of dentists didn’t believe in the possibility of cross-infection between the dental office and dental laboratories, while the truth is the dental office-laboratory connection may be represented a potential cross-infection pathway if no effective disinfection procedures are taken. The dentists in their clinics receive patients need to repair their fractured or unfilled dentures and already these dentures are contaminated with any types of microorganisms. Thus, American Dental Association (ADA) stated that may every dental patient should be treated as a potential source of infection.

Also, the dental laboratory technicians handle these materials during steps of prosthesis fabrication. They may expose the products to be contaminated with various microbial and fungal organisms.

Mean while, less than 60% of the denture wearers use any one disinfectant due to the cost of the product \(^{(8)}\). Therefore denture disinfection should be of low cost to be affordable to most of the denture wearers. As regard the colonies reductions measurements of Candida albicans colonies in either PMMA and Flexible Acrylic plates demonstrated extremely good inhibition for both Myrrha and Sage extract solutions , compared with percentage reduction of chlorohexidine with mean p-value (0.01) (figure 1 and 3),

A known method of disinfection is the use of chemical disinfectant solutions, which may interfere,
with frequent exposure with the properties of PMMA or the flexible acrylic \(^{13-14}\), because the long-term immersion of the prosthesis in chemical disinfectant may cause deterioration of denture base material by changing mechanical properties of acrylic resin \(^{15}\). Therefore, there are several drawbacks in the use of such chemical agents for disinfection of prosthesis\(^{16}\).

Chlorohexidine 2% solution is considered the excellent choice among chemical antiseptics for dental biform control \(^{6}\). A previous studies stated that new dentures should be disinfected before replacement of the prosthesis in patient’s mouth and before and after adjustment procedures, because a large variety of disease are caused by many micro-organisms which are found in patient’s mouth such as streptococci pneumonia, staphylococcus aurus, Escherichia coli, and mycobacterium bovis \(^{(Haake SK. )}^{10}\). Also, denture induced stomatitis was reported to be an inflammatory reaction of the denture - bearing mucosa, being characterized by different degrees of erythema and affects many complete upper denture wearers \(^{9}\). Candida albicans is still reported as the primary etiologic agent, Which can easily adhere to acrylic prosthesis surfaces.

A well known method of disinfectants is the use of chemical disinfectant solutions, which may interfere with frequent exposure with the properties of PMMA or the flexible acrylic \(^{10}\), because the long-term immersion of the prosthesis in chemical disinfectant might cause deterioration of denture base material via changing mechanical properties of acrylic resin \(^{Al Faraj, S (2005)}\). Therefore, there are several drawbacks or side effects in the use of such chemical agents for disinfection of prosthesis \(^{(Haake SK. )}^{10}\).that is encourage this study to use natural products in treating the dental plagues.

Chlorohexidine 2% solution is considered the best choice among chemical antiseptics for dental biform control \(^{8}\). It is a broad- spectrum disinfectant that works by destroying the cell membrane and precipitating in the cell cytoplasm. So, chlorohexidine 2% solution is convenient to use it as control antiseptic agent versus plant extract solutions for comparison.

Thus, research is necessary to find an alternative method of disinfection by using solutions which do not cause any significant alteration in the structure of prosthesis. Furthermore, This research considers both Myrrha and Sage extract solutions are promising solutions maybe use as alternative solution in treating Candida albicans in either PMMA and Flexible Acrylic plates.

**Acknowledgment**

We thank all the members in Iraqi company for biological laboratories, Baghdad- Iraq especially in the Microbiology laboratory for their cooperation in providing us the Candida and helping us to make some experiments in their lab.

**Ethical Clearance:** This research was accepted to achieve the fulfillment as a research paper according to the Iraqi criteria committee to be published in any scientific research paper.

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**Conflict of Interest:** Nil

**REFERENCES**


Husband Participation in Birth Prepareness and Complication Readiness and Utilization of Delivery Services in Indonesia

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¹Master Program in Public Health, ²Epidemiology Department, Faculty of Public Health, Universitas Indonesia

ABSTRACT

Husband has potential to engage in three obstetric delays, so husband is expected to be involved in preparation of childbirth and decision-making action against possible complications, in addition to play a role in maintaining maternal health during pregnancy. Although the government has attempted this in the antenatal care policy, participation of husbands has been less successful in motivating mothers to utilize maternal services. This study identify the association between husband participation in birth prepareness and complication readiness with the utilization of delivery services in Indonesia.

Research with cross sectional approach, using data of IDHS 2012. Women of childbearing age who gave birth within one year before survey become population. Sample size was 504 respondents. Husband’s participation is measured only in birth prepareness and complication readiness. Data were analyzed using logistic regression test.

Utilization of delivery service at health facility in Indonesia is 73.2%, but well birth prepareness and complication readiness as husband’s participation in mother’s health is only equal to 46.8%. The results of logistic regression test showed that woman whose birth prepareness and complication readiness well-planned by her husband, more likely to utilize delivery service at health facility (POR 1.59; 95% CI 1.06-2.37) than woman whose birth prepareness and complication readiness not well-planned by her husband. In this study, maternal age, maternal education, husband education, index of economic status, and decision makers also proved statistically significant in relation with utilization of delivery services at health facilities.

There is an association between husband’s participation in birth prepareness and complication readiness with the utilization of delivery services in Indonesia. Optimizing antenatal care becomes a moment for health workers to encourage husband participation in birth prepareness and complication readiness.

Keywords: Indonesia, husband participation, delivery services, birth, complication readiness

Introduction

Since pregnancy until childbirth’s phase, woman may face dangerous conditions (1). These complications and all of the immediate causes of maternal deaths can be prevented and minimized (19) by utilizing routine and integrated antenatal care involving husbands and families, so that maternal health status is monitored as well as birth prepareness and complication readiness (BP/CR) can be implemented (10).

Coverage of delivery services by skilled birth attendant in Indonesia in 2014 was 88.86%, this number have not met the target of the Strategic Plan of Ministry of Health 2010-2014 (9). Utilization of delivery services in health facilities is also influenced by the household’s identification about the existence of delivery facilities. In fact, only about half (57.5%) of a total 2.445 husbands, who discussed with health workers about their wife’s pregnancy (18).

Husband has potential to engage in three obstetric delays (8). Therefore, the husband is expected to be involved in birth prepareness and decision-making on complications or emergency condition that may occur during pregnancy and childbirth.

The study shows the condition that the indirect husband’s participation through financing of maternal health services is higher than direct participation through accompanying their wives in antenatal care visit during pregnancy (21). The role of husband is also important in
knowledge and attitude of the wife in the selection of skilled birth attendant for labor and referral \(^{(16)}\). Male knowledge of antenatal care improves the utilization of health care services and decision-making by women \(^{(4,23)}\). While the presence of a husband during a woman’s antenatal visit to a health facility is a significant determinant for utilization of delivery services, and also improves birth preparedness \(^{(3,15)}\). This study aims to identify the association of husband participation in BP/CR with the utilization of delivery services in Indonesia.

**Method**

The study was conducted by cross sectional approach, using secondary data obtained from the Indonesian Demographic and Health Survey (IDHS) in 2012. Woman of childbearing age who gave birth within one year before the survey were conducted into the study population. The sample size is 504 respondents.

The variables in this study were husband’s participation in BP/CR, delivery services, and as covariate variables: woman’s age, parity, woman and husband education, index of economic status, residential area, and decision-maker. BP/CR is based on 5 components: delivery places, birth attendants, delivery costs, transportation, and potential blood donors. BP/CR is categorized as as well-planned, if the husband performs more than 3 points of preparation. Delivery services are classified as non-health facility when delivery was done at respondent or other person’s house with help either by non-health or health worker. To test the hypothesis we used chi-square test, and also conducted multivariate analysis to control the confounding factors.

**Results**

Most of women were 25-34 years old, nearly half with parity of 2-3 children, most of them had secondary education, and decide everything related to their health together with their husbands.

**Table 1: Characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Woman’s age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 24</td>
<td>161</td>
<td>31.9</td>
</tr>
<tr>
<td>25-34</td>
<td>263</td>
<td>52.2</td>
</tr>
<tr>
<td>≥ 35</td>
<td>80</td>
<td>15.9</td>
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<table>
<thead>
<tr>
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<tr>
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<td>233</td>
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<td>46.2</td>
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<td>≥ 4</td>
<td>63</td>
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<table>
<thead>
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<tbody>
<tr>
<td>Primary</td>
<td>110</td>
<td></td>
<td>21.8</td>
</tr>
<tr>
<td>Secondary</td>
<td>299</td>
<td></td>
<td>59.3</td>
</tr>
<tr>
<td>Higher</td>
<td>95</td>
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<td>18.8</td>
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<table>
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<tr>
<td>Primary</td>
<td>114</td>
<td></td>
<td>22.6</td>
</tr>
<tr>
<td>Secondary</td>
<td>294</td>
<td></td>
<td>58.3</td>
</tr>
<tr>
<td>Higher</td>
<td>96</td>
<td></td>
<td>19.0</td>
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<table>
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<th>Husband’s knowledge about high risk and danger sign of pregnancy</th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Not well</td>
<td>489</td>
<td></td>
<td>97.0</td>
</tr>
<tr>
<td>Well</td>
<td>15</td>
<td></td>
<td>3.0</td>
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<table>
<thead>
<tr>
<th>Index of economic status</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Very low</td>
<td>81</td>
<td></td>
<td>16.1</td>
</tr>
<tr>
<td>Low</td>
<td>108</td>
<td></td>
<td>21.4</td>
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<tr>
<td>Middle</td>
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<tr>
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<td>22.0</td>
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<th></th>
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<tr>
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<td></td>
<td>54.0</td>
</tr>
<tr>
<td>Urban</td>
<td>232</td>
<td></td>
<td>46.0</td>
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</table>

<table>
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<tr>
<th>Decision maker</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td>0</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Husband</td>
<td>86</td>
<td></td>
<td>17.1</td>
</tr>
<tr>
<td>Wife</td>
<td>136</td>
<td></td>
<td>27.0</td>
</tr>
<tr>
<td>Wife and husband</td>
<td>282</td>
<td></td>
<td>56.0</td>
</tr>
</tbody>
</table>

| Total                    | 504 |     | 100 |

Most of husbands (58.3%) also have secondary education, but almost all (97%) have poor knowledge about high risk and danger sign of pregnancy. Figure 1 shows more details about husband’s knowledge.

**Figure 1: Husband’s knowledge in high risk and danger sign of pregnancy**

Most of women (73.2%) have utilized delivery services by labor in a health facility but Table 2 shows that majority of husbands have not well-planned in BP/CR. While the well-planned in BP/CR as one of their
participation in maternal health only amounted to 46.8%. The components of BP/CR performed by the husband seen in Figure 2.

Table 2: Husband’s participation in BP/CR in Indonesia

<table>
<thead>
<tr>
<th>BP/CR</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not well-planned</td>
<td>268</td>
<td>53.2</td>
</tr>
<tr>
<td>Well-planned</td>
<td>236</td>
<td>46.8</td>
</tr>
<tr>
<td>Total</td>
<td>504</td>
<td>100</td>
</tr>
</tbody>
</table>

The most common component of BP/CR by the husband was preparation of place of delivery, followed by preparation of birth attendant, delivery costs, transportation, and at least preparation potential blood donors.

Table 3: Association of husband’s participation in BP/CR and utilization of delivery services in Indonesia

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non Health Facility</th>
<th>Health Facility</th>
<th>p-value</th>
<th>POR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>BP/CR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not well-planned</td>
<td>83</td>
<td>31.0</td>
<td>185</td>
<td>69.0</td>
</tr>
<tr>
<td>Well-planned</td>
<td>52</td>
<td>22.0</td>
<td>184</td>
<td>78.0</td>
</tr>
</tbody>
</table>

The proportion of woman who using delivery services at health facility is greater in the husband group with well-planned BP/CR. Statistically, there is a significant association. The woman whose BP/CR well-planned by her husband, more likely to utilize delivery service at health facility (POR 1.59; 95% CI 1.06-2.37) than woman whose BP/CR not well-planned by her husband.

Table 4: Association covariate variable and utilization of delivery services in Indonesia

<table>
<thead>
<tr>
<th>Covariate variable</th>
<th>Non Health Facility</th>
<th>Health Facility</th>
<th>p-value</th>
<th>POR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Woman’s age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 24</td>
<td>53</td>
<td>32.9</td>
<td>108</td>
<td>67.1</td>
</tr>
<tr>
<td>25-34</td>
<td>60</td>
<td>22.8</td>
<td>203</td>
<td>77.2</td>
</tr>
<tr>
<td>≥ 35</td>
<td>22</td>
<td>27.5</td>
<td>58</td>
<td>72.5</td>
</tr>
<tr>
<td>Parity</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>48</td>
<td>23.1</td>
<td>160</td>
<td>76.9</td>
</tr>
<tr>
<td>2-3</td>
<td>63</td>
<td>27.0</td>
<td>170</td>
<td>73.0</td>
</tr>
<tr>
<td>≥ 4</td>
<td>24</td>
<td>38.1</td>
<td>39</td>
<td>61.9</td>
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<tr>
<td>Woman’s education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>52</td>
<td>47.3</td>
<td>58</td>
<td>52.7</td>
</tr>
<tr>
<td>Secondary</td>
<td>72</td>
<td>24.1</td>
<td>227</td>
<td>75.9</td>
</tr>
<tr>
<td>Higher</td>
<td>11</td>
<td>11.6</td>
<td>84</td>
<td>88.4</td>
</tr>
<tr>
<td>Husband’s education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>49</td>
<td>43.0</td>
<td>65</td>
<td>57.0</td>
</tr>
<tr>
<td>Secondary</td>
<td>70</td>
<td>23.8</td>
<td>224</td>
<td>76.2</td>
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<tr>
<td>Higher</td>
<td>16</td>
<td>16.7</td>
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<td>83.3</td>
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<tr>
<td>Index of economic status</td>
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<td>48</td>
<td>59.3</td>
<td>33</td>
<td>40.7</td>
</tr>
<tr>
<td>Low</td>
<td>40</td>
<td>37.0</td>
<td>68</td>
<td>63.0</td>
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<tr>
<td>Middle</td>
<td>21</td>
<td>22.1</td>
<td>74</td>
<td>77.9</td>
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<tr>
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<td>9.20</td>
<td>99</td>
<td>90.8</td>
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<tr>
<td>Very high</td>
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<td>14.4</td>
<td>95</td>
<td>85.6</td>
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<table>
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<tr>
<th>Residential area</th>
<th>Rural</th>
<th>31</th>
<th>11.4</th>
<th>241</th>
<th>88.6</th>
<th>reff</th>
<th>reff</th>
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</thead>
<tbody>
<tr>
<td>Urban</td>
<td>104</td>
<td>44.8</td>
<td>128</td>
<td>55.2</td>
<td>0.0005</td>
<td>0.16 (0.10-0.25)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Decision-maker</th>
<th>Husband</th>
<th>31</th>
<th>36.0</th>
<th>55</th>
<th>64.0</th>
<th>reff</th>
<th>reff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wife</td>
<td>34</td>
<td>25.0</td>
<td>102</td>
<td>75.0</td>
<td>0.079</td>
<td>1.69 (0.94-3.04)</td>
<td></td>
</tr>
<tr>
<td>Wife and husband</td>
<td>70</td>
<td>24.8</td>
<td>212</td>
<td>75.2</td>
<td>0.042</td>
<td>1.71 (1.02-2.86)</td>
<td></td>
</tr>
</tbody>
</table>

Woman’s age, woman’s education, husband’s education, index of economic status, and decision-maker statistically show significant differences between women who utilize delivery services in non-health and health facility. The result of multivariate analysis with logistic regression shows that there is no confounding variable on the association. Based on the final model of logistic regression it is known that there is a statistically significant association between husband participation in BP/CR with utilization of delivery services in Indonesia (p-value= 0.024). In the final model of logistic regression, woman whose BP/CR well-planned by her husband, more likely to utilize delivery service at health facility (POR 1.59; 95% CI 1.06-2.37) than woman whose BP/CR not well-planned by her husband.

**Discussions**

The BP/CR program in Indonesia called “P4K”, becomes one of the strategic programs to reducing maternal death rate in Indonesia. In this case, unoptimize implementation of this program maybe a factor that encourage the lack of husband’s participation. So the momentum to prepare women, husband and family through P4K which integrated in antenatal care give less impact to utilization service delivery. This assumption is supported by the concept described by JHPIEGO. By the BP/CR at the individual, family, and community level, together with the service providers, and supported by good facilities and policy elements, it can lead mothers and their pregnancies to good outcomes through the utilization of maternal health services.

Study on the implementation of P4K at Puskesmas in Ambon found that communication in P4K practice still unclear. Communication between midwives, or between the provider and family, community and cross-sector has not been well established. Information and education is only given to pregnant women at the time of antenatal visit at health center. This finding supported by research in Papua New Guinea, which shows that awareness and education about safe mother initiatives never targeted to men or husband. Husbands are given the information only when their wives have problems related to pregnancy.

Based on research in Malawi, in practice, impact of husband’s participation in utilization of maternal, newborn and child health services in a gender perspective has constraints and encouragement. Barriers at the health facility level for men is the uncomfortable and embarrassed feelings, that increased while attending a maternal health discussion.

Despite these obstacles, generally from the gender perspective, men have been aware of the importance of male involvement in seeking care and health services for mothers and children, particularly in encouraging their wives to perform antenatal care, accompanying wives when attending antenatal care visits and decision to delivery at the health facility.

In this research, the tendency to utilize delivery services at health facilities is different according to the participation of husbands in BP/CR. Most of the mothers who utilized delivery services at health facilities were in the group with husbands which well-planned in BP/CR. Woman’s age, woman’s education, husband’s education, index of economic status, and decision-maker, are also statistically proves significant association with utilization of delivery services in health facilities.

Women 25-34 years old have more plan for their pregnancy and childbirth which then encourages them to give birth at a health facility. Early marriage will change educational opportunities. Education levels are lower in women who get married early and more likely to leave school to devote their time to domestic matter, childbirth and parenting. Woman’s education level is one of the most important determinants for women in using delivery services. Higher education level of a woman, then the use of maternal health services will also increase. Woman’s education and knowledge factors related to
BP/CR also influence their practice in BP/CR (3). Thus, appropriate interventions are necessary to facilitate a group of women with primary education or no education.

Husband’s education is also a significant factor in utilization of antenatal care and safe delivery services, but it is also possible that this factor are not strong as woman’s education (17). This is possible because woman’s education, socioeconomic and other demographic factors, substantially reduce the effect of husband’s education.

Women with high economic status index more likely to use delivery services at health facilities. Utilization of delivery service in health facility decreased in proportion to the decline in household economic status index. These results are consistent with studies showing that the economic status of women is one of the most important determinants of safe delivery (17). Household income or socioeconomic factors are very important in the utilization of antenatal and delivery services (14,15). In general, uneven use of maternal and infant health services is closely linked to poverty, women’s education, geographic factors and social development. Poor and uneducated mothers have difficulty in using health care facilities because of limited costs and ignorance (5).

Among adult women, the most affected person in the utilization of antenatal care services is the woman itself, but in the utilization of delivery services, husband has the greatest influence (20). This finding supports the results of our study showing that women who make health-related decisions together with husbands are more likely to utilize delivery services at health facilities than women with husbands as the only decision makers.

Conclusions

The empowerment of maternal health services is to maintain the health of mothers since the time of pregnancy until postpartum. And the BP/CR during pregnancy and childbirth by involving pregnant women, husbands and families, is part of integrated antenatal care. Optimizing antenatal care needs to be done to encourage the participation of husbands in BP/CR. Strengthening the participation of husbands through pregnancy classes for husband, or appropriate counseling with partners during antenatal visits based on characteristics identification, such as age, education, index of economic status, and decision-makers, is expected to improve the quality of antenatal care and delivery services in Indonesia.

Acknowledgement

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Ethical Clearance: Taken from Ethics Commission for Research and Community Health Services, Faculty of Public Health, Universitas Indonesia.

Conflict of Interest: We have no conflict of interest to declare.

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A Study of Some Biochemical Parameters in Blood Serum of Patients with Congestive Heart Failure

Entedhar Riffat Sarhat1, Salim Jasim Khalaf1, Mahde Salih Hamad1
1Clinical Biochemistry, Dentistry college/University of Tikrit, Tikrit, Iraq

ABSTRACT

Background and Aim: The goal of this study was to investigate the association between copeptin, chemerin and different biochemical and anthropometric parameters in congestive heart failure (CHF) compared to the healthy control group.

Patients and Method: This was a case-controlled, cross-sectional study of eighty-one consecutive patients (48 men, age 64 years, 33 women, age 60 years) and 81 age-matched healthy control individuals presented to the Tikrit Teaching Hospital in Tikrit province with a diagnosis of HF between June 2017 and January 2018. Demographic and anthropometric variables were estimated. Serum levels of copeptin, chemerin and apelin were measured in fasting blood samples.

Results: There was a significant increase in serum copeptin, and Chemerin, cholesterol, triglycerides, levels whereas decreased in HDL in CHF group when compared with healthy controls. Receiver operator characteristic curve (ROC) curve analysis revealed similar efficacies of copeptin and chemerin levels in their ability to detect unstable plaques with areas under the curve of [(AUC=0.959; 95% CI, 0.890 to 0.990, cutoff value >14.6 pg/mL)], and (AUC=0.917; 95% CI, 0.835 to 0.967, cutoff value >41.76), respectively. Whereas, apelin (AUC=0.785; 95% CI, 0.680 to 0.868, cut of point >0.231).

Conclusion: Future analysis of chemerin copeptin’s biological actions, and measurement of copeptin, copeptin levels in the omental depot as well as in the circulation of humans with or without CHF and its co morbidities, will help to define its role in the pathogenesis of these diseases.

Keywords: Copeptin, chemerin, cholesterol, heart failure

Introduction

Congestive heart failure (CHF) is a leading cause of morbidity in adult population characterized by dyspnea, fatigue, and signs of volume overload, which may include peripheral edema and pulmonary rules1. Various mechanisms participate to this condition, including structural or functional cardiac disorder, neurodegenerative diseases., vascular disease, oxidative stress, genetics, environment and conditions of cohabitation, biological agents2, biochemical changes in cardiac myocytes, interstitium, or both, associated with release of various biochemical markers like cytokines, neurohormones (renin-angiotensin-aldosterone and adrenergic nervous systems), enzymes, etc., which can be estimated in blood3.

The aim of this study is to investigate some biochemical changes in serum considering Copeptin, Chemerin in in women with and without CHF.

Subjects and Method

We reviewed the medical records of 41 patients with CHF who were preserved in Tikrit Teaching Hospital, between March 20016 and January 2017. The diagnosis of CHF was based on clinical sings and a combination of clinical symptom and echocardiogram.

Echocardiographic measurements were performed according to guidelines and recommendations by the European Association of Echocardiography(4).

Subjects had blood drawn in the resting state at least 2 h after a light breakfast, collected into tubes without anticoagulant in order to obtain serum. None of the collected samples was icteric or hemolysed. Copeptin, chemerin and apelin were evaluated by enzyme immunoassays (ELISA).

Data were provided based on a computer program (SPSS) version IBM 21. Using student unpaired and
paired T test, Chi-square test Regression and Correlation analysis.. Statistical Analysis: p < 0.05 was accepted as the significance level. The ROC was used to find out the best cut off serum value of copeptin, chemerin, apelin predicting in CHF patients.

**Result**

The clinical and laboratory characteristics of the whole study cohort and CHF groups are presented in Tables 1. This study included 82 individuals, group II patients were diagnosed to have CHF clinically and laboratory [48 males and 33 females] with age (60.24 ± 6.4). A control group (group II ) of 81 health subjects [39 males and 42 females] with age (61.43 ± 5.8).

Copeptin levels were significantly higher in the patient compared to the control group (18.100 ± 2.128 vs 12.462 ± 1.148 pmol/L), Chemerin (54.78 ± 8.47 vs 36.38 ± 4.72 ng/ml), apelin(0.41 ± 0.1379 vs 0.251 ± 0.1297 ng/ml).

In the correlation analysis, apelin (p = <0.0001, r = - apelin) and the Chemerin level (p = <0.0001, r = 0.443) were positively correlated with copeptin.

The ability of log copeptin and chemerin as a predictor for CHF was explored using a ROC curve. The area under the curve (AUC) for copeptin to predict CHF were 0.959 with 95% Confidence interval (0.890 to 0.990), the optimal cut-off value >14.6 pmol/L (sensitivity 87.80 and specificity 100.00) with P value 0.001(figure:1).

The corresponding values of chemerin was 0.917 ng/ml with (95% CI: 0.835 to 0.967) (sensitivity 70.73 and specificity 100.00), cut of point >41.76 ng/ml with P <0.0001, (figure:2). whereas for apelin was 0.785 with (95% CI: 0.680 to 0.868), (sensitivity 70.73 and specificity 100.00), cut of point >0.231 with P <0.0001(figure:3). This article indicating that serum levels of copeptin and chemerin are the best biomarkers differentiating subjects with CHF(Table:2).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>CRF Patients</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of subjects</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td>Sex (M/F)</td>
<td>48/33</td>
<td>39/42</td>
</tr>
<tr>
<td>Age (years)</td>
<td>60.24 ± 6.4</td>
<td>61.43 ± 5.8</td>
</tr>
<tr>
<td>Chemerin (ng/ml)</td>
<td>54.78 ± 8.47</td>
<td>36.38 ± 4.72</td>
</tr>
<tr>
<td>Copeptin (pmol/L)</td>
<td>18.100 ± 2.128</td>
<td>12.462 ± 1.148</td>
</tr>
<tr>
<td>Apelin (ng/ml)</td>
<td>0.41 ± 0.1379</td>
<td>0.251 ± 0.1297</td>
</tr>
</tbody>
</table>

Table 1: Comparison between group I and group II as regard demographic and laboratory data

<table>
<thead>
<tr>
<th>Parameters</th>
<th>AUC</th>
<th>CI</th>
<th>Cut-off</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>P-value</th>
<th>Youden’s index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copeptin</td>
<td>95%</td>
<td>0.890 -0.990</td>
<td>&gt;14.6</td>
<td>87.80</td>
<td>100.00</td>
<td>&lt;0.001</td>
<td>0.8780</td>
</tr>
<tr>
<td>Chemerin</td>
<td>95%</td>
<td>0.835 - 0.967</td>
<td>&gt;41.76</td>
<td>70.73</td>
<td>100.00</td>
<td>&lt;0.0001</td>
<td>0.7073</td>
</tr>
<tr>
<td>Apelin</td>
<td>95%</td>
<td>0.680 - 0.868</td>
<td>&gt;0.231</td>
<td>70.73</td>
<td>100.00</td>
<td>0.0001</td>
<td>0.4146</td>
</tr>
</tbody>
</table>

Table2: Descriptive statistics of diagnostic accuracy of the various biomarkers for CHF

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Difference between areas</th>
<th>Standard Error</th>
<th>CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apelin ~ Chemerin</td>
<td>0.133</td>
<td>0.0543</td>
<td>0.0262 to 0.239</td>
<td>0.0146</td>
</tr>
<tr>
<td>Apelin ~ Copeptin</td>
<td>0.174</td>
<td>0.0581</td>
<td>0.0604 to 0.288</td>
<td>0.0027</td>
</tr>
<tr>
<td>Chemerin ~ Copeptin</td>
<td>0.0416</td>
<td>0.0379</td>
<td>-0.0327 to 0.116</td>
<td>0.2725</td>
</tr>
</tbody>
</table>

P-values of pair-wise comparison of ROC curves are given
Figure 1: The ROC curve of copeptin

Figure 2: The ROC curve of chemerin

Figure 3: The ROC curve of apelin

Figure 4: Comparison of ROC curves for copeptin, chemerin, and apelin in patients CHF

Discussion

In our study it was found that copeptin, chemerin, and apelin is higher in case groups than and control group.

Copeptin is a 39-aminoacid glycopeptide, which is a stable COOH-terminal part of the precursor preprovasopressin and concealing a leucine-rich core segment, it is protruded as a promising surrogate marker for assessment of vasopressin levels, also it seems useful in cardiovascular disease. After conveyance to the pituitary gland from the hypothalamus and split of the pre-pro-AVP, copeptin is secreted into the blood stream in an equimolar ratio to AVP from hypothalamus neurohypophysis in response to osmotic as well as non-osmotic stimuli. It acts primarily through its receptors including V1, V2, V3, P2-purinergic receptor (P2R) and oxytocin receptor (OTR). V1 receptors cause vasoconstriction and a positive ionotropic effect in cardiac and smooth muscle. In the circulation copeptin is stable in plasma and serum at room temperature, has a long half-life, and is not bound to platelets, and methodologically easier to determine. Thus, Copeptin is therefore, routinely used as a surrogate marker for AVP.

After AMI the chief cause for copeptin release is assumed to be acute endogenous stress. Furthermore, secretion of copeptin is also related to the alterations
in fluid status. Hence, during AMI in the acute phase hemodynamic changes might prompt copeptin release\(^7,8\). Additionally, copeptin and AVP participate to the complex energizing of the humoral stress response, consequential in cortisol and adrenocorticotropic release. Therefore, the prompt increase in copeptin level can be elucidated by volume overload and myocardial injury\(^9\).

Several studies recently have indicated the possible prognostic value of copeptin in heart failure patients. Stoiser et al\(^10\) showed that copeptin was an good prognostic pointer in progressive HF. Gegenhuber et al\(^11\) showed that copeptin was an excellent prognostic indicator acute decompensated HF. Khan et al\(^12\) assessed the prognostic marker of copeptin in patients after MI in the context of HF.

Chemerin, is also known as (tazarotene-induced gene 2 protein (TIG2) or retinoid acid receptor responder 2 (RARRES2)), is a novel adipocyte-secreted factor (16 kDa), encoded by the RARRES2 gene, which plays a crucial role in regulation of immune response, insulin resistance, and adipose maturation, differentiation, and metabolism\(^13-15\).

Chemerin was validated to play as an inflammatory intermediary to production of pro-inflammatory cytokines and encourage the relocation of immature dendritic cells and macrophages. Prevention of TNF-a-induced VCAM-1 expression and monocyte adhesion due to anti-inflammatory role of chemerin via discouragement the energizing of NF-KB and p38 in vitro\(^16\). It is recognized that switching macrophages into foam stimulates the instigation and development of atherosclerosis, and aggregation of macrophages increased which persuade the laceration of plaque and the formation of thrombus in progressive atherosclerosis\(^17-20\). Consequently, chemerin can participate in various stages of atherosclerosis by regulating immigration of the macrophages\(^21\).

Apelin exerts load-independent positive inotropy and increases coronary blood flow by vascular dilation, thereby providing beneficial effects in failing hearts\(^22,23\). This comes in agreement with the study of Chun et al.\(^24\), who revealed that apelin reduced formation of atherosclerosis by angiotensin (Ang)II receptor blocker. however Hashimoto et al.\(^25\), shown that apelin/APJ system is the arbitrator of oxidative stress-related AS in vascular tissue.

**Conclusions**

Circulating copeptin levels are elevated and have the potential biomarker to be used clinically as a diagnostic as well as prognostic marker of CHF patients. However, Future research is however required to determine the pathophysiological and clinical significance of Copeptin, Chemerin in patients with CHF.

**Limitation:** The small sample size, needed a more subjects and for longer period was limitation of the study.

**Ethical Clearance:** Taken from University of Tikrit

**Source of Funding:** Self

**Conflict of Interest:** None

**REFERENCES**


Vision and Geographical Information System: Toward Spatial Statistical analysis in Parts of Iraq

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ABSTRACT

Short wavelengths in the visible part of the electromagnetic spectrum ranging from (380- 500) nm; which includes blue light, can trigger critical physiological responses including circadian rhythm synchronization and pupil constriction. Blue light cause damage to human eye, and the blue light hazard term has been coined to highlight this dangerous.

The blue light can result in the demise of healthy tissue via apoptosis of photoreceptors and critical retinal pigment epithelial (RPE). This slow motion process during which damage accumulates over a lifetime has been embroiled in the different types of refractive errors i.e. (longsighted, shortsighted, and astigmatism) and pathogenesis of retinal degenerative diseases.

In the present work, patients were chosen at random from different areas in Iraq and studied for the period from November 2016 to March 2017. The refractive errors of the eye were corrected using two different methods (traditional and blue light filter) spectacles. The blue-light filtering glasses were using for improving the vision of the patients and gave the best results for correction’s compared with traditional glasses. This relationship was examined to investigate the potential correlation between the presence or absence of a blue filter on the refractive errors for the optics of the eye, and the inter-pupillary distance (IPD).

Geo-spatial techniques were also utilized with the aid of Geographical Information System (GIS) software for analysis and interpretation of the acquired data over a wide range of Iraq.

A new statistical model designed by us using Statistical Package for the Social Sciences (SPSS) to show if the results is significant or not significant. Results utilized with a statistically significant value less than 0.0001 for spherical-blue-filter, cylindrical-blue value, and axis-blue filter.

Keywords: Blue-light, Refractive errors, Spectacles, GIS

Introduction

Visual recognition happens when light strikes the retina, which consists of an intricate structure of exceedingly concentrated cells that forms the different layers of the eye. prior reaching to the retina, incoming light must penetrate the visual media. This is the transparent tissues and liquids that lie between the front piece of the eye and the retina. The ocular media consists of the cornea, lens, (aqueous and vitreous) humor. This media either transmit lights or absorbs, depending on the wavelength of the incident light as shown in the figure (1).

Figure 1: Visible light path until penetration of the ocular media

Almost the majority of the UV that reaches the eye is absorbed by the cornea or the crystalline lens. In the

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eyes of an adult only (1-2) % of incoming UV is transmitted to the retina. The cornea and the crystalline lens also block infrared above 980 nm; and the vitreous humor absorbs the infrared above 1400 nm which is not absorbed by the crystalline lens. The net consequence of light filtered by the ovisual media is that the retina is presented almost noticeable to the visible part of the solar spectrum as shown in the following figure (2)\(^2\).

Figure 2: UV light transmission through the eye

Ultra-Violet and visible light with high energy cause the crystalline lens to fluoresce very few, resulting in a slight fog which may be increase with progressing in age. Lenses that prevent the entire blue spectrum is impractical for everyday use not just because of their effects on color perception and facial appearance, but also the reason is the physiologically important circadian function which requires exposure of the eye to light in the range 470 nm \(^3,4\).

Blue light reduction at specific wavelengths can be achieved by increasing the reflection on the first side of a lens and/or reducing UV by minimize UV reflection on the back side of the lens \(^5\).

The vision and protection from harmful blue light sources and their effect on vision are shown in the following figure (3).

Figure 3: Vision (Risk and protection) from harmful blue light
The IPD is the distance between the optical axes and the pupils of a binocular visual system. It is an important part of spectacle prescription. IPD is measured in mm to ensure an accurate fit when writing prescriptions for glasses. The average adult has an IPD of 62 mm, although the normal range for most individuals is between (54, and 74) mm [6,7].

An incorrect IPD value can cause headaches, fatigue, nausea, blurry vision, and double-vision images. In particular, a minor error in the IPD with a complex prescription can have adversely undesirable outcomes [8].

Materials & Method

The patients were randomly chosen from different parts of Iraq and examined for the period from November 2016 until March 2017. The relations between different examinations types were studied as outlined in the following section.

The first part of this work involved the use of two types of corrections for refractive errors of the eye; these are (traditional and blue light filter) spectacles.
The map shows the location of the male butterfly majority and female butterflies in Iraq. In this paper, a coding of $\sim 2$ for males and 0 for female was used in the identification of the butterflies.

There are three essential colors in this map; two of them identify male and female; the third one showed the lack of presence any butterflies, and the other mixing colors without dot showed mix availability of both sexes.

Measurement of the IPD is necessary for acquiring accurate solutions and suitable spectacles for correction of refractive errors. The IPD ranged from (57- 70) mm in the patients.

Figure 10: Frequencies of the inter-pupillary distance (IPD) in millimeters

Figure 11: Distribution of the selected patients over a wide range in Iraq according to IPD (mm)

Figure 12: Prescription of the eye glasses after examination over wide range in Iraq : (a): Sphere (b): Cylinder (c): Axis

**Results & Discussion**

The results from figure (14) showed that the values of the spherical spectacles ranged from ($-1.626 - 1.373$) D and the values of the cylindrical spectacles ranged from ($- 0.125 -1.145$) D.

The negative values are associated with myopic and astigmatic myopic eyes; the positive values are associated
with hypermetropic and astigmatic hypermetropic eyes; while zero implies Plano, which is associated with emmetropic eyes (eyes with no refractive errors).

The result of using the spherical-blue- filter, cylindrical-blue-filter, and axis-blue-filter for the correction of the refractive errors of the eye indicates better results by comparing with the results without blue filters for the same patients because the power of the lens of the eye needs lesser correction for the blue filter than the traditional approach as indicated in figure (13)

![Figure 13: Comparison between results for correction for cylindrical of RE using the traditional and blue filter](a)

![Figure 14: New statistical model displays the effects with significant value lesser than 0.0001 for spherical-blue-filter, cylindrical-blue value, and axis-blue filter](b)

**Conclusions**

Blue-light irradiation is an important part of digital eye strain and the way it affects people of every age. Every opportunity was taken to instruct, demonstrate, instruct, and provide a way to protect our patients from potential blue light harm.

Some wavelengths in the blue-violet range are damage to the retina, and cumulative damage of the blue-light is implicated in retinal disorders. For spectacle to protect the retina, this implies that in addition to protecting against UV light, attenuation of high energy blue violet light is required. But for normal physiologic functioning, the spectacles must prevent this light without reducing transmission in the chronobiological spectral band.

Furthermore, patient acceptance may be limited when glasses are clearly colored and distort their color perception, as is the case with most blue absorber spectacles. To improve vision and support color perception, glasses should offer high transmittance of
all wavelengths of the visible light outside the UV and phototoxic blue bands.

In recommending selective filtering of phototoxic wavelengths, doctors have an ideal chance to perform a truly beneficial function, protecting vision for a lifetime, even if the patient is being examined for the errors of refraction and the prescription of new spectacles.

**Ethical Clearance:** This paper done under Ethical Approval is Required by our university.

**Source of Funding:** By myself

**Conflict of Interest:** There is no any potential conflicts of the manuscript

**REFERENCES**


Ground Water Quality that Affects Human Health in Scavenger Settlements around Integrated Waste Disposal Site (TPST) Bantargebang Bekasi, Indonesia

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ABSTRACT

All this time, the design of Bantargebang TPST follows the rules of landfilling with sanitary landfills which are equipped with leachate management and gas control, but in reality the implementation is open dumping (stacking without processing). Pollutants in leachates such as hardness, manganese, nitrites, iron and heavy metals will flow away from the landfill that causes pollution in surface and ground water, this way is very dangerous and harmful because it will cause permanent pollution to ground water. The resulting impact of poor water quality is the occurrence of various types of diseases and direct impact on humans. The danger of water pollution caused for human health is divided into two, namely direct and indirect hazards. This research uses quantitative method. Quantitative method is used to calculate groundwater quality analysis using laboratory instrumentation. The research results concludes that ground water quality, which is by chemical parameters all meet the quality standards, while by microbiological parameters all have not met the quality standard. This research can contribute to providing advice on building sanitation and governance of groundwater preservation at the Bantargebang TPST.

Keyword: Ground water, human health, leachate, water quality

Introduction

Groundwater is one of the vital water sources on the planet that is extracted for basic uses such as drinking, agriculture and industry¹. Groundwater also accounts for 43% of global irrigation water use and is more suitable for irrigation purposes compared to surface water². Water is an important factor for all life and human survival and has an important role both for drinking and economic sector³. Protecting water resources from pollution is highly necessary⁴. Water quality has an important role in determining the ecological environment and public health⁵. Clean and safe water is the main source for human, social and economic development⁶. Adequate quality water resources are a prerequisite for economic development and ecological integrity⁷. The decline of water quality is one of the problems of the 21st century⁸. Many factors influence water quality, such as natural processes (for example, weather, rainfall, soil erosion), anthropogenic activities (for example, agriculture, urban and industrial activities) and increased utilization of water resources⁹. Because of the effects that have been explained, thus water quality has become a serious problem in the world. Freshwater resources may become scarce in the future, which will threaten the use of water resources, especially for drinking water and economic development¹⁰.

We can know the quality of water by testing it. The tests are divided into three kinds including physical, chemical and microbiological testing. The traditional method for water quality assessment uses a comparison of water quality parameters with its standard limits¹¹. Water quality can be defined by several parameters, which are physical parameters (temperature, turbidity, dissolved...
solids, etc.), chemical parameters (pH, dissolved oxygen, BOD, metal content) and microbiological parameters (presence of plankton, bacteria)\(^{(12)}\).

Bantargebang TPST is one of the largest Solid Waste Disposal Sites in Indonesia located in Bantargebang District, Bekasi City, West Java Province, Indonesia. Bantargebang TPST has been operating since 1989 based on the West Java Governor’s decree. The area of Bantargebang Waste TPST is 108 Ha, and has been operating since 1989, and it is estimated that the amount of waste buried has reached more than 30 million tons with an average height of 18 meters per zone. Based on data from the Environment Agency of DKI Jakarta, the volume of waste flowing into the Bantargebang TPST every day reaches 6,500-7,000 tons/day.

The resulting impact of poor water quality is the occurrence of various types of diseases and direct impact on humans. The danger of water pollution caused for human health is divided into two, namely direct and indirect hazards. The immediate danger that occurs can be caused by consuming contaminated water by drinking it directly or through other intermediaries, as well as using polluted water for daily activities. The potential for groundwater pollution is very high if there is infiltration from leachate or waste water from human activities. The main source of pollution is a landfill that is not managed properly.

TPST of waste must be well planned, its aspects of space availability, finance, operations and maintenance as well as the impact on the environment must be well-assessed. Waste that is not decomposed properly will produce gas and liquid which is known as leachate. Gas from decomposition can cause odors and respiratory problems for residents around the location\(^{(13)}\). Water pollutants such as hardness, manganese, nitrites, iron and heavy metals will flow away from landfills which cause pollution to the surface and ground water\(^{(13)}\). The purpose of this study is to analyze the groundwater quality of affects human health in scavenger settlements Integrated Waste Disposal Site Bantargebang.

**Methodology**

This research was carried out around the Bantargebang Bekasi TPST located in the Bantargebang sub-district, Ciketing Udik Village. Ciketing Udik Village lies in south of Bantargebang TPST. This research uses quantitative method. Quantitative method is used to calculate water quality analysis using laboratory instrumentation. This research uses a cross sectional research design in which researchers conduct observations or data collection at a time (point time approach). Water testing is carried out in KAN accredited laboratories namely PAM Jaya. Groundwater quality data is compared with the provisions of the Ministry of Health of Republic of Indonesia Regulation No. 492/MENKES/PER/IV/2010 concerning drinking water quality standard requirements.

**Results**

The results of the analysis of groundwater (chemical and microbiological) in Ciketing Udik Village at a distance of 300 and 400 meters can be seen in Table 1. The results of the analysis are compared with Ministry of Health Regulation No. RI. 492/MENKES/PER/IV/2010 concerning the requirements for drinking water quality standard.

**Table 1: Test results for groundwater quality on settlements of scavenger residents around Bantargebang TPST for the period of October 2018**

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Unir</th>
<th>Quality standard</th>
<th>Groundwater of residents 1, distance 300m</th>
<th>Groundwater of residents 2, distance 300m</th>
<th>Groundwater of residents 1, distance 400m</th>
<th>Groundwater of residents 2, distance 400m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
<td>Chemical</td>
</tr>
<tr>
<td>1.</td>
<td>Nitrite</td>
<td>mg/l</td>
<td>3</td>
<td>0.01</td>
<td>0.013</td>
<td>&lt;0.004</td>
<td>0.016</td>
</tr>
<tr>
<td>2.</td>
<td>Nitrate</td>
<td>mg/l</td>
<td>50</td>
<td>25.718</td>
<td>1.038</td>
<td>9.9</td>
<td>6.12</td>
</tr>
<tr>
<td>3.</td>
<td>Cyanide</td>
<td>mg/l</td>
<td>0.07</td>
<td>&lt;0.028</td>
<td>&lt;0.028</td>
<td>&lt;0.028</td>
<td>&lt;0.028</td>
</tr>
<tr>
<td>4.</td>
<td>Flouride</td>
<td>mg/l</td>
<td>1.5</td>
<td>0.17</td>
<td>&lt;0.16</td>
<td>&lt;0.16</td>
<td>&lt;0.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Microbiology</td>
<td>Microbiology</td>
<td>Microbiology</td>
<td>Microbiology</td>
</tr>
<tr>
<td>5.</td>
<td>Total of Coliform</td>
<td>MPN/100ml</td>
<td>0</td>
<td>&gt;60</td>
<td>&gt;60</td>
<td>46</td>
<td>&gt;60</td>
</tr>
<tr>
<td>6.</td>
<td>Fecal Coli (E. Coli)</td>
<td>MPN/100ml</td>
<td>0</td>
<td>6</td>
<td>14</td>
<td>1</td>
<td>11</td>
</tr>
</tbody>
</table>
Discussion

Chemical Parameters

Fluoride: The fluoride test results for each distance can be seen in Table 1. The fluoride test results carried out at four sample points at a distance of 300 meters and 400 meters all meet the required quality standard, which is 1.5 mg/l. The results of the fluoride parameter test in groundwater at the research location have a relatively small content. High fluoride content will cause fluorosis. In addition, fluoride contamination in groundwater is also caused by industrial waste water(14) while the research locations are not industrial locations so that fluoride contamination due to industrial waste disposal can be minimized.

Nitrite: Nitrite test results for each distance can be seen in Table 1. Test results conducted at four sample points at a distance of 300 meters and 400 meters for Nitrite parameters, of all points at a distance of 300 meters and 400 meters meet the required quality standard, which is 3 mg/l. The result of this test indicates that the biological process activity in the organic matter reformation is quite low so that the nitrite content in the research area is also low. Because this is in line with Kurniawan’s research(15) that shows average nitrite content in well water in landfills area Galuga Cibungbulang Bogor already exceeds the limit allowed according to Water Quality Criteria Class I.

The high nitrite content is caused by the huge number of nitrifying bacteria so that more nitrite content is formed while at the research location there are not many nitrifying bacteria so the nitrite content is still relatively low. Nitrite is an intermediary in the oxidation of ammonia to nitrate so this is also in line with Hamzaraj’s statement(16) that in the results of this research there are no nitrite results that exceeds the quality standard, compared to the nitrate results obtained there is also no nitrate that exceeds the quality standard.

Nitrate: The nitrate test results for each distance can be seen in Table 1. The nitrate test results carried out at four sample points at a distance of 300 meters and 400 meters all meet the required quality standard, which is 50 mg/l. This is in line with previous research in the same place by Manurung(17) the result obtained is nitrate concentration of 18.4 ppm, while in another study by Kurniawan(15) shows average nitrate content in well water in landfills area Galuga Cibungbulang Bogor is 0.06 mg/l. That value is still around the maximum limit allowed based on water standard criteria.

In addition, the low nitrate content in the research area is caused by regional conditions which are mostly not agricultural land. The research area is a landfill that is not polluted by pesticides. In line with Wardhana’s theory(18) that the most nitrate content is caused by agricultural waste due to the use of nitrogen fertilizers. Furthermore, the temperature also affects the concentration of nitrates in water bodies, in line with Kim(19) groundwater temperature obtained from the results of this research meets the quality standards so that it does not affect the concentration of nitrate.

Cyanide: The cyanide test results for each distance can be seen in Table 1. The cyanide test results carried out at four sample points at a distance of 300 meters and 400 meters all meet the required quality standard of 0.07 mg/l. The results of this test shows that the quality of groundwater in the research area has not been polluted by hazardous chemical contents such as cyanide. Cyanide content in water will be harmful to human health. Cyanide in the form of free compounds will be very toxic, this is in line with the statement of Pitoi.(20) Based on the results of laboratory tests that have been carried out on chemical parameters that are directly related to human health, the quality of chemical parameters of the groundwater in scavenger settlements around the Bantargebang TPST obtained within distance of 300 and 400 meters meets the required quality standards. Thus, chemically the quality of groundwater in scavenger settlements around Bantargebang TPST can still be said to be good and adequate for consumption.

Microbiology Parameters

Coliform bacteria and Fecal coli (E. coli): Microbiological tests conducted to determine the quality of groundwater around Bantargebang TPST shows total coliforms and E. coli can be seen in Table 1. Observations of groundwater samples at a distance of 300 meters found total coliform content >60 MPN/100ml whereas for E coli contains 6-14 MPN/100 ml each. These results do not differ greatly from the quality of groundwater at a distance of 400 meters. The distance of 400 meters obtained the total coliform content of 46 MPN/100ml to > 60 MPN/100ml, while the content of E. coli was 1-10 MPN/100ml. The content of coliform bacteria and E. coli for all research areas shows that it has exceeded the maximum permissible limit according to quality standards.
The analysis shows that the content of coliform bacteria in well water was higher than that of fecal coli bacteria. This condition indicates that in the research location more waste is sourced from plant debris, food scraps, and animal carcasses which are the main substrate for the growth of coliform bacteria (Enterobacter aerogenes). These bacteria together with rainwater can directly or seep into the topsoil and eventually absorbed and accumulated in well water.

The source of microbiological pollutants from the garbage disposal system can seep into the ground water vertically or horizontally. This is in line with the research conducted by Kurniawan(15) who did the water quality analysis in TPA Galuga area within 400-700 meter distance of his research area the well water is already polluted by E. coli bacteria. This result is supported by Kurniawan(15) who found that bacteria could move as far as 830 meter from contaminants source, so that so the result of groundwater microbiology quality in Ciketing Udik Sub-district contains positive coliforms and E. coli.

The presence of coliforms and E. coli in large quantities or above the quality standards limit indicates that the groundwater has been contaminated by pathogenic bacteria that harm the body. In addition, research from Usman(21) which shows that well water can be contaminated by leachate from latrine if the toilet is not far enough from water source while a research of Graham(22) shows that latrine can be source of groundwater pollutant. Untreated latrines can produce negative externalities, which not only affect the owner but also the surrounding community.

Based on the results of laboratory tests carried out on microbiological parameters, the quality of the microbiological parameters of the groundwater in scavenger settlements around the Bantargebang TPST obtained with a distance of 300 meters and 400 did not meet the required quality standards. Thus, microbiologically the quality of groundwater in scavenger settlements around Bantargebang TPST can be said to be inappropriate for consumption.

**Conclusion**

Ground water quality at a distance of 300 and 400 meters shows chemical parameters, all chemical parameters meet the quality standard. In microbiological parameters, all microbiological parameters have not met the quality standard.

**Competing Interest:** This research is part of final task of Universitas Indonesia students, thus, there is no competition in conducting this research.

**Ethical Clearance:** The study was approved by the Institutional Review Board (IRB) of School Of Environmental Science, Universitas Indonesia.

**Source of Funding:** This research is self funding students

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The Effect of Special Exercises using Virtual Reality Glasses (3D) in Learning the Stop Attack with the Epee of the Students

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ABSTRACT

The study included the following: The two researchers tackled the methods and teaching methods that aim to increase the speed of learning, which includes the treatment of many variables that occur during the lesson, because of their active role in the learning process. The importance of the study comes through an attempt to learn the effect of the use of virtual reality glasses (3D) in learning some of the offensive skills with the Epee. The objectives of the study were:

1. Preparing the 3D system for virtual reality glasses.
2. Preparation of exercises using the virtual reality glasses to learn some of the offensive skills with the Epee for students.
3. Learn about the effect of exercises on the use of virtual reality glasses to learn some of the offensive skills with the Epee for students.
4. To identify the differences between the control group and experimental in the impact of exercises for the use of virtual reality glasses to learn some of the offensive skills with the Epee for students. While the second section was devoted to theoretical and similar studies. The third section used the experimental method to fit the nature of the current study. The research society included 60 students from the College of Physical Education and Sports Sciences, Kufa University for the academic year 2017-2018. (30) Students in each group. The fourth section was to discuss the results and analysis and allocated the fifth section of the conclusions and recommendations were as follows:

In light of the results of the research, the following conclusions were reached:

1. There are differences between the pre-test and the post-test for the experimental group and for the post-test in the sample members of the students of the third stage of the Faculty of Physical Education and Sports Sciences. As a result of following the curriculum prepared by the researcher.
2. The experimental group that used exercises using virtual reality glasses (3d) achieved the advantage of the control group in learning some of the offensive skills with the sword.

Keywords: Special exercises, virtual reality glasses, stop attack with the Epee of the students.

Introduction

One of the most important mathematical sciences that lead the learner to achieve the best performance in most skills. Individual and collective games is dynamic learning which is characterized by inclusiveness and diversity. It requires the use of many types of teaching aids, exercises, equipment and aids that directly affect the process of learning motor skills and developing physical and, which aims at achieving the desired goal through the use of equipment, tools, exercises and different techniques and methods to help him to get to know the details of the performance of any skill in dueling.

The researchers noted the fact that there is slow and weak in the process of learning the offensive skills in the Epee due to the use of repetitive methods which give the learner the nature of boredom and boredom. In order to reach better levels and increase the speed of learning, the researcher saw the use of special exercises...
as well as The use of a virtual presentation tool, which is the virtual reality glasses through which exercises are displayed to increase the spirit of excitement and excitement in the students, which enables the student to see the performance of the technique in a modern three-dimensional and two-speed as well as three directions, which enables the student to understand and recognize the movement Skills and skills in a better and faster way. The importance of research is in the preparation of special exercises using the 3D virtual reality viewer.¹

As the importance of learning the basic skills of the sport of fencing and how to upgrade them comes through the examination of new methods in order to link to the best performance of the student, the scientific and technical development requires that the person to pass him and uses what is best to serve the educational process and success and reach to the highest levels, Fencing sport is a science, art, and a way to provide the individual with health and self-confidence as well as to develop balanced thinking and give him a broad horizon for perception and thinking.²

The importance of research in the preparation of special exercises suited to the ability of students and their abilities using a modern view of the virtual reality viewer in a three-dimensional view as well as three directions and the speed of normal and slow.

Research Objectives

1. Preparation of the system for the preparation of the (3D) virtual reality system.

2. Preparation of exercises using the virtual reality glasses in learning some of the offensive skills with the Epee of the students.

3. Learn the effect of exercises using the virtual reality glasses (3D) in learning some of the offensive skills with the Epee for students.

4. Identify the differences between the experimental groups and control the effect of exercises using the virtual reality glasses (3 d) to learn some of the skills of the attack with the Epee of the students.

Research Methodology

The researcher used the experimental method to suit the nature of the problem. The experimental approach is “an attempt to control all the basic factors affecting the variable or dependent variables in the experiment except one factor controlled by the researcher and modified in a certain way with a view to determining and measuring its effect on the variable or dependent variables.”³

Society and Sample Research: Society “is all individuals, persons, objects or situations that are the subject of the research problem studied by the researcher”. The researcher identified the research society represented by the students of the third stage in the Faculty of Physical Education and Sports Sciences University of Kufa for the academic year (2017-2018) of (60). The sample was randomly selected by drawing lots between two divisions (B, C), the number of (30) students, where the results of (5) students were excluded for the benefit of the pilot experience, also excluded the results of (5) others for being retarded and deferred and players, and thus became Division B represent the control group.

Homogeneity and Equivalence of the Sample: For the purpose of starting a single project plan, and to verify the accuracy and accuracy of the results, the researcher conducted a homogeneity between the sample according to the variables (age, weight, length, arm length). The mean and standard deviations were also extracted. Our distribution is normal when the torsion value is between (+1, -1), as shown in Tables (1-2).

Table 1: The homogeneity of the research sample variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>Cm</td>
<td>178.4</td>
<td>2.41</td>
<td>178</td>
<td>0.26</td>
</tr>
<tr>
<td>Weight</td>
<td>Kg</td>
<td>66.5</td>
<td>3.7</td>
<td>68</td>
<td>0.98</td>
</tr>
<tr>
<td>Age</td>
<td>Year</td>
<td>22</td>
<td>1.0</td>
<td>23</td>
<td>0.75</td>
</tr>
<tr>
<td>Arm length</td>
<td>Cm</td>
<td>78.5</td>
<td>1.9</td>
<td>78</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Equal Search Groups: The researcher used the t-test to determine the differences between the two groups in the technical tests of the counter attack (the counter-attack, the stop attack) in order to achieve equality between the two groups and the results are shown in Table (2).
Table 2: Stop attack and anti-time attack in experimental and control groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Control group</th>
<th>Experimental group</th>
<th>(t) calculated</th>
<th>Level of significance</th>
<th>Significance of differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean  SD</td>
<td>Mean  SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop attack</td>
<td>Number</td>
<td>2.25  0.44</td>
<td>2.05  0.75</td>
<td>1.01</td>
<td>0.31</td>
<td>Non sig.</td>
</tr>
<tr>
<td>Anti-time attack</td>
<td>Sec.</td>
<td>1.70  0.57</td>
<td>1.90  0.78</td>
<td>0.91</td>
<td>0.36</td>
<td>Non sig.</td>
</tr>
</tbody>
</table>

Value (t) calculated at the significance level (0.05)

Through the table (2), which shows that all was the greater than 0.05, which indicates that the results were not significant. This indicates the equality of the two groups in the pre-test.

Field Research Procedures:

Identify the Skills of the Subject: The offensive skills were chosen by the fire weapon, which is within the curriculum of the Faculty of Physical Education and Sports Sciences at the University of Kufa, which is taught in the second course. Accordingly, the skills of the counter attack (the counter-attack, the stop attack) were selected.

Characterization of the tests used in the study

Test the Skill of the Stop Attack:

Objective of the Test: assess the level of performance of the skill of the stop attack.

Tools Used: Epee number 2, measuring tape, as imaging cameras

Test Description: from the standby mode (Oncard) When giving the start signal, the student to perform the stop attack at the beginning of the attack of the player by striking the blade of the student’s opponent’s weapon and the process of appeal.

Registration: The rating is calculated by the evaluators so that each attempt is evaluated from (10) grades and the three attempts are combined and divided into three.

The Pilot Study: The researcher conducted the experimental experiment for the technical tests on Monday, January 22, 2018 in the fencing room at the College of Physical Education and Sports Sciences, the University of Kufa on (5) students to determine its validity and its applicability to the members of the research sample later.

During the exploratory experiment conducted on the students, the following were identified:

1. Fit the tests of offensive skills with the Epee of the sample.
2. The appropriateness of the devices and tools used and their safety.
3. Identify the time taken for the tests.
4. Know the problems and obstacles that may occur during the main experiment.
5. Extraction of the scientific basis for tests.

Procedures of the Main Experiment:

Pretests: The researcher conducted the Pretests by sampling the sample performance of the studied skills. The sample was sampled on Monday, 19/02/2018 and at the hall of the College of Physical Education and Mathematical Sciences at the University of Kufa. The researcher then conducted the Pretests of the skills (The attack of the attack was repeated, the attack was repeated, the attack was resumed, the attack was completed). After that, the photography of the skill performance of the members of the research sample was transferred to the CDs and presented to the experts and specialists.

To achieve the research objectives, the researcher prepared special exercises for the experimental group and used the virtual reality glasses (3D) to learn the skills in question

Posttests: The post-test was conducted on Monday, April 23, 2018, at the College of Physical Education and Sports Sciences hall, University of Kufa where the research sample was photographed for the skills (stop attack, counter-attack). On the CDs of and presented to experts and specialists in the field of fencing to assess the performance of skill, taking into account the same conditions and conditions and instructions used by Pretests.
Results are Discussed: View, analyze, and discuss the results of the mean, standard deviations and t.test testing of the Pre and Posttests of the skills in question for the experimental group.

Table 3: Pretest and posttest in experimental and control groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Pretest</th>
<th>Posttest</th>
<th>(t) Value</th>
<th>Level of significance</th>
<th>Significance of differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>Stop attack</td>
<td>2.05</td>
<td>0.75</td>
<td>7.20</td>
<td>0.61</td>
<td>24.59</td>
</tr>
<tr>
<td>Control</td>
<td>Anti-time attack</td>
<td>2.25</td>
<td>0.44</td>
<td>5.80</td>
<td>0.83</td>
<td>17.89</td>
</tr>
</tbody>
</table>

Value (t) calculated at a significance level (0.05)

The results of countries (3) showed that there were significant differences between the pre and posttests of the experimental group for the skill of the stop attack where the value of (t) calculated (24.59) and below the level of significance (0.05)

View, analyze and discuss the results of computational circles, standard deviations and t.test testing of pretest and remote tests of skills for the control group: The results of countries (3) showed that there were significant differences between the pre and posttests of the control group for the skill of the stop attack, where the value of (t) calculated (17.89) and below the level of significance (0.05). Discuss the results of the computational and standard deviations and test (t.test) for the pretest and remote tests of the skills of the experimental group.

Discuss the results of the computational and standard deviations and test (t.test) for the pretest and remote tests of the skills of the control group: In the light of the extracted data as shown in Table (3), which shows the differences of the pretest and remote tests of the control group in the skills performance values of the skills (stop attack, counter-attack) and for the tests of the dimension. This explains that the method used by the teacher in the process of learning skills has led to learn positively, that the teacher of the article used a certain method of teaching and that he is experienced and specialized in learning the skills of the Epee so the learner was acquired skill through the teacher of the article, which follows the normal method, preferably to teach in the educational stages of the best teachers km The researcher attributed the learning to the skillful performance as a result of the training and effectiveness of the skills used in the educational methods, where the method of the Emiri is “an immediate response to the decisions and instructions of the teacher,” as the learner in the traditional educational method used, is an imitator and executor of the orders issued and instructions and instructions by teacher “.5

Discuss the results of the computational and standard deviations and test (t.test) for the pretest and remote tests for the skills of the experimental group and the researcher attributed this to the ability of these exercises and their repetitions as “the more repetition of the skill becomes more automatic and decrease tension and become more efficient and efficient movement” and the repetition is “Typical without significant change in motor responses “.5 This may be included in the educational units to increase in the implementation of vocabulary and parts and the application of exercises for skills as well as the presentation of exercises that create a positive and effective atmosphere and excitement and draw a clear picture and a concept of how to perform skill.

View, analyze and discuss the results of computational and standard deviations and test (t.test) for the remote tests of the experimental and control groups of skills: Table (4).shows mean, standard deviations and t.test values calculated in the post-test of the control and experimental groups.
Table 4: Remote test in experimental and control groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Post (Experimental)</th>
<th>Post (Control)</th>
<th>(t) Value</th>
<th>Level of significance</th>
<th>Significance of differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop attack</td>
<td>Number</td>
<td>7.20 0.61</td>
<td>5.80 0.83</td>
<td>5.00</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Value (t) calculated at a significance level (0.05)

Table (4) shows that there are significant differences in the remote tests between the control and experimental groups for the skill of the stop attack where the value of (t) calculated (5.00) was below the level of significance (0.05).

Discussion of computational and standard deviations, and t-test testing of remote tests of experimental and control groups of skills: Table 4 shows that the results of the tests showed the improvement in the experimental group in all the research variables. The differences were evident in the results of the post-test in favor of the experimental group when compared to the control group, which was improved but less than the experimental group. The effect of the specific exercises on him showed clearly. This confirms that the educational curriculum prepared by the researcher, including the special exercises and the presentation of the three-dimensional effect has been effective and clear in improving the skill and technical performance of the students and this indicates that the curriculum built on the basis of scientific correct purpose took into account all the considerations of study and individual differences Bad Physical, or other skills.

Conclusions

Through the presentation, analysis and discussion of the results, the following conclusions were reached:

1. There are differences between the pre-test and the post-test for the experimental group and for the post-test in the sample members of the students of the third stage of the Faculty of Physical Education and Sports Sciences. As a result of following the curriculum prepared by the researcher

2. The experimental group that used exercises using virtual reality glasses (3d) achieved the advantage of the control group in learning some of the offensive skills with the Epee.

Ethical Clearance: Taken from University of Kufa

Source of Funding: Self

Conflict of Interest: None

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Laser Applications in Some Clinical Blood Constituents Analysis (Bilirubin, Triglyceride and Hemoglobin)

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Abstract

The requirements of the present work are a laser system were consisted of laser source (Argon-ion laser power 1 mw), laser power meter combined with Silicon detector, power supply, cuvette and sample holder were used in the estimation of concentration or activity of some blood constituents (Bilirubin, Triglyceride, and Hemoglobin). A spectrophotometer also used in the measurement of absorption spectra of these constituents and determine the absorption peaks which gave a good agreement with the values by Argon-ion laser (488-514.5 nm). The comparison of the required results of a number of different test samples of patients group (male and female) with different ages in the clinical laboratories using both laser and spectrophotometer, denotes to the ability of the use of Argon-ion laser and helps to minimize errors where the laser had a characteristics that not available in other light sources.

Keywords: Laser applications, Argon ion laser, Blood constituents analysis, Bilirubin, Triglyceride, Hemoglobin

Introduction

One of oldest dreams of power is to have intense beams of light which could be controlled and projected over great distances. Now with the advent of laser, this old dream seems to have come true.

The laser is a source of light which has several important properties (monochromatic light, brightness, directional and coherent). The first experimental laser was successfully constructed and tested in 1960 by Maiman¹. Laser applications are very wide in all fields such as industrial, military, communication, medical and others). In medicine, there are many types of laser are used such as Co₂–laser (10.6µ), Nd-Yag laser (λ=1.064µ), Dye laser (Tunable), Excimer (UV) and Argon- ion laser. The Argon- ion laser was used in several applications such as in medicine (Ophthalmology), in clinical blood constituents and biological fluid analysis. Its emits several wavelengths but the most intense (488 and 514.5 nm). But why Argon-ion laser is used in blood constituent analysis? The answer of this question is²–³:

1. The Argon-ion laser works with high efficiently and multi wavelengths (UV and visible), but most intense (488 and 514.5 nm).
2. It is absorbed by chemical materials and biological fluids at human body.
3. It is not absorbed by water which is enters in large percent of blood.
4. It’s wave lengths are agree with large number of principle clinical analysis.

Figure 1: The Laser System

Laser System Components: The laser system has been configured for using in clinical applications. It’s composition that was used is shown in fig. (1). This figure is consisted of the following:
1. **The Sources (Argon-ion laser):** It’s wavelengths (488 nm) or (514.5 nm) with power (1 mw).

2. **Cuvette Holder:** This holder must be fixed without vibration, also with two circular apertures with a same diameter which allowed a laser ray to passes through it.

3. **Cuvette:** Its dimensions (5×1x1cm) with high transmission for visible wavelengths, this kind of cuvette is made of quarts which it allowed to visible wavelengths to be transmitted by it.

4. **Laser Power-meter:** This device with high sensitive for power (µw) and (mw), also for wavelengths lie in visible and (UV) of electromagnetic spectrum. It is connected with silicon detector to receive the light signals and converted to electrical signals.

5. **Power Supply:** It is used power supply with (5v). This system is set up with (alignment) to avoid any losses in intensity of incident ray on the cuvette which contains the (Test sample).

**Laser System Work:** This work depends on measurement the power of transmitted ray from test sample with respect to the total power of laser source, when the total power of laser is used (Argon-ion laser) with (1mw) power, it is noted that the transmitted power from test sample is represents a function of percent transmission (T%). From this one can calculates the (transmittance) and the absorbance and the activity of inzyme for any clinical analysis. The laser system can be worked using the following steps:

1. Provide each of a laser source, power-meter and power supply.
2. Put the Blank solution in the cuvette.
3. Must be calibrated power supply and put the indicator on the maximum (100% T; 1mw).
4. Put the test sample in the cuvette.
5. Measure the transmitted power from the test sample which is represents the function of percent transmittance, then from this, calculates the absorption of each of test and control, after that calculates the concentration or activity for that analysis as shown in Tables (1, 2 and 3).

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Test By Laser</th>
<th>Test By Spectrophotometer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T</td>
<td>C</td>
</tr>
<tr>
<td>1</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
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<td>3</td>
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<tr>
<td>20</td>
<td>80</td>
<td>96</td>
</tr>
</tbody>
</table>

Table 1: Results of Bilirubin for group samples by using the laser and comparing with spectrophotometer
Table 2: Results of Triglycerides for group samples by using the laser and comparing with spectrophotometer

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Test</th>
<th>Triglycerides Concentration (mg/100 ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laser</td>
<td>Spectrophotometer</td>
</tr>
<tr>
<td></td>
<td>T%</td>
<td>Abs.</td>
</tr>
<tr>
<td>1</td>
<td>70</td>
<td>0.15</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>0.41</td>
</tr>
<tr>
<td>4</td>
<td>44</td>
<td>0.36</td>
</tr>
<tr>
<td>5</td>
<td>68</td>
<td>0.17</td>
</tr>
<tr>
<td>6</td>
<td>47</td>
<td>0.33</td>
</tr>
<tr>
<td>7</td>
<td>31</td>
<td>0.51</td>
</tr>
<tr>
<td>8</td>
<td>74</td>
<td>0.13</td>
</tr>
<tr>
<td>9</td>
<td>41</td>
<td>0.39</td>
</tr>
<tr>
<td>10</td>
<td>48</td>
<td>0.32</td>
</tr>
<tr>
<td>11</td>
<td>63</td>
<td>0.20</td>
</tr>
<tr>
<td>12</td>
<td>71</td>
<td>0.15</td>
</tr>
<tr>
<td>13</td>
<td>35</td>
<td>0.45</td>
</tr>
<tr>
<td>14</td>
<td>38</td>
<td>0.42</td>
</tr>
<tr>
<td>15</td>
<td>51</td>
<td>0.29</td>
</tr>
<tr>
<td>16</td>
<td>66</td>
<td>0.18</td>
</tr>
<tr>
<td>17</td>
<td>42</td>
<td>0.38</td>
</tr>
<tr>
<td>18</td>
<td>13</td>
<td>0.88</td>
</tr>
<tr>
<td>19</td>
<td>33</td>
<td>0.48</td>
</tr>
<tr>
<td>20</td>
<td>29</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Table 3: Results of (Hemoglobin) for group samples by using the laser and spectrophotometer comparing with standard samples for Kit

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Samp.</th>
<th>St.</th>
<th>Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laser</td>
<td>Spectrophotometer</td>
<td>Laser</td>
</tr>
<tr>
<td>1</td>
<td>0.00</td>
<td>0.00</td>
<td>0.46</td>
</tr>
<tr>
<td>2</td>
<td>0.15</td>
<td>0.15</td>
<td>0.37</td>
</tr>
<tr>
<td>3</td>
<td>0.30</td>
<td>0.30</td>
<td>0.37</td>
</tr>
<tr>
<td>4</td>
<td>0.46</td>
<td>0.45</td>
<td>0.37</td>
</tr>
</tbody>
</table>
Table 4: Calculation of concentration or activity for some clinical analysis

<table>
<thead>
<tr>
<th>No.</th>
<th>Clinical analysis</th>
<th>Calculation</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bilirubin</td>
<td>Table (1)</td>
<td>mg/100ml</td>
</tr>
<tr>
<td>2</td>
<td>Triglyceride</td>
<td>( \frac{A_{\text{test}}}{A_{\text{ref}}} \times 100 )</td>
<td>mg/100ml</td>
</tr>
<tr>
<td>3</td>
<td>Hemoglobin</td>
<td>Determine the total Hemoglobin concentration of the samples directly from the calibration curve.</td>
<td>mg/100ml</td>
</tr>
</tbody>
</table>

By the spectrophotometer, it is noted the value of absorption before the power of laser system. In Table (4) was indicated how to calculated the concentration or activity for each analysis which are measured as referred to each of them with medical units. Also it is calculated the value of each of correlation coefficient \( r \) \([-1 \leq r \leq 1]\) and relative standard Deviation (R.S.D %) as shown in the formula:

\[
\text{R.S.D.} = \frac{\delta}{x} \times 100
\]

Where \( \delta \) is the Standard Deviation; \( x \) is the average calculation or the average results by each of laser system and spectrophotometer.

Conclusions

From the results which are measured by the laser system by comparing the spectrometers with the results for clinical chemistry laboratories, it was concluded the following:

1. The laser system for the clinical analysis is simple, accurate and fast.
2. The laser system is economical in terms of using the chemical materials which it used for clinical analysis.
3. Small sample of blood is enough to do this analysis by laser.
4. The time is very fast to measure the clinical analysis.
5. It is possible to programming all the results that leading to reduce the staff.
6. The results are accurate because the laser is monochromatic wave length.

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the Department of Physics/College of...
Science/Mustansiriyah University, Baghdad, Iraq and all experiments were carried out in accordance with approved guidelines.

REFERENCES

The Effect of Exercises Relative Strength and Absolute Method Pyramid Attached to the Compound Whey in Some Variables Left Ventricle of the Heart and the Explosive Ability and Accuracy Index Shooting of the Jump Players Kerbala Club Young Handball

Rafid Saad Hadi¹, Hussein Hassoun Abbas¹, Hassim Abdul J. Saleh¹
¹University of Kerbala, The College of Physical Education and Sports Sciences, Iraq

ABSTRACT

The researchers saw the use of absolute and relative strength exercises in the hierarchical style attached to the whey compound, which is used for the first time in the training of handball players, to the knowledge of researchers in some variables of the left ventricle of the heart and the development of explosive capacity and the index of skipping skill, in an attempt to solve some of the problems facing The aim of the study was to identify the effect of absolute and relative force exercises in the hierarchical method attached to the whey complex in some left ventricular variables of the heart, explosive ability and the skill of shooting of the young handball players. Effectiveness of the two groups in the investigated variables.

The researchers used the experimental design of the two experimental groups. They identified the research community with the players of the Kerbala Club in the youth handball team (17-19 years) and they were all selected as a sample of the research. They were randomly divided into two experimental groups, and they concluded that both groups developed the search variables, but the group that used the relative strength in the hierarchical method was the best in developing the explosive capability and the accuracy index of the skipping skill.

Keywords: strength, method pyramid, compound whey and accuracy.

Introduction

Due to the importance of relative and absolute power in the field of sports and its association with many sports, especially the handball game through its association with the development of the force it needs in a great way and in most forms, it has become one of the important pillars used to train the players in order to help increase the development of their athletic performance,¹ Which comes from the evolution of physiological, and explosive capacity is one of the elements of the physical preparation of handball players are clearly contributing to improving the efficiency of the left ventricle of the heart and the achievement through the development of explosive capacity of the Shooting of jumping, The dietary supplements are suitable for such exercises on the one hand and for the other, on the other hand, such as whey or whey, which provides a large amount of full amino acids that the body cannot manufacture and which builds muscle and tissue.²

Hence the importance of this study to identify the superiority of the impact of exercises relative strength or absolute strength exercises in the hierarchical method with the use of serum whey in some variables left ventricle of the heart and the explosive ability and the index of skipping skill of jumping for young handball players. Through the follow-up of the researchers to the training of handball players, who are involved and interested in this game, saw the adoption of trainers on the traditional methods in the evolution of the basic variables in the game and not experimenting with modern methods and know which is better, while not using the compound whey as a dietary supplement for players during the duration of training and preparation.

Therefore, the researchers considered the use of absolute and relative strength training in a hierarchical manner with the use of the whey compound, which is used for the first time in the training of handball
players to the knowledge of researchers to see its effect in some variables of the left ventricle of the heart and the development of explosive capacity and the index of skipping skill.

Research Aims:

1. Recognition of the effect of absolute and relative strength exercises in the hierarchical method attached to the serum whey in some left ventricular variables of the heart and the explosive ability and index of skill of Shooting of the jump for young handball players.

2. Identification of the effect of the two groups on the studied research variables.

Research Hypotheses:

1. There is a positive effect of exercises of absolute and relative strength in the hierarchical approach attached to the serum whey in some variables left ventricle of the heart and the explosive ability and the index of skipping skill of jumping for young handball players.

2. The superiority of the relative strength exercises in the hierarchical method to the absolute strength exercises in the hierarchical method attached to the whey compound in the investigated variables.

Research Methodology and Field Procedures:

Research Methodology: The researchers used the experimental design of the two experimental groups.

Search Community and Sample: The researchers identified the research community with the players of Kerbala club in the ages of 17-19 years and they were all selected as a sample for research and in a comprehensive inventory method. They were randomly divided into two experimental groups with 8 players per group. The first group exercises the nesibe force in the pyramidal method attached to the whey complex, and the second group used the absolute strength exercises in the hierarchical manner that is attached to the whey compound.

In order to proceed from one line of research, the researchers sought to extract the homogeneity and equivalence of the individuals of the research sample in the investigated and extraneous variables.

Means, tools and devices used in research:

Means of gathering information

(Tests, observation, resolution).

Tools and devices used.

(2), a precision ball (50 × 50) number (4), a handball number (12), a medical ball weighing (2 kg), an iron chair, 1), 2 strap, measuring tape, medical balance, vertical jump plate (30 × 150 cm), vertical barrier, eco device, laptop calculator (1).

Search Procedures:

Characterization of Tests

Physical Tests: All left-ventricular changes of the examined heart were measured using an echocardiography device through a specialist physician. The measurements are measured in the laboratory’s comfort and effort situations directly.

Physical and Skill Tests:

The first test: throwing the medical ball from sitting on the chair ⋅

Second test: vertical jump test ⋅

The third test: the speed and accuracy of the Shooting of jumping high:

Pre Test: A preliminary test was carried out on Sunday, 31/12/2017, at the stadium of the closed martyr hall in Kerbala governorate.

Main Experience: After completing the tests, the researchers introduced the exercises that were prepared in the training program for the research sample at the beginning of the main section of the training module and then the main part is completed together with the same exercises of the coach, as follows:

1. The starting date and completion of the exercises from 4/1 to 26/2/2018.

2. Exercises were applied in the special numbers stage.

3. The duration of the experiment (8) weeks distributed over (24) training units at the rate of three units per week.
4. A special trainer has been assigned to each group who are given the exercises scheduled for them on Thursdays, Saturdays and Mondays and at the same time, after completion they are merged again to complete the training module for them under the supervision of their coach.

5. The researchers determined the intensity of exercise between (85-100%).

6. Whey compound was given for 8 weeks at one dose per day.

Post-test: The post-test was conducted on Thursday, corresponding to 1/3/2018, taking into account the same conditions and conditions in the Pretest.

**View and Analyze the Results and Discuss Them:**

View and analyze the results of the tests in the Pre and Post measurement of the two groups of research and discuss: For the purpose of testing the first hypothesis, the researchers used the T test for the corresponding samples of the two research groups, as shown in Tables (1) and (2).

Table 1: Shows the level and type of significance of the first experimental group in the Pre and Post tests

<table>
<thead>
<tr>
<th>Tests</th>
<th>Units</th>
<th>Pretest</th>
<th>Posttest</th>
<th>(t)value</th>
<th>Level of significance</th>
<th>Type of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The explosive power of the arms</td>
<td>Watt</td>
<td>828.17 40.55</td>
<td>1588.20 10.92</td>
<td>38.743</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>The explosive power of the two legs</td>
<td>Watt</td>
<td>1254.52 35.32</td>
<td>1875.59 82.57</td>
<td>16.731</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Shooting skill of jumping high</td>
<td>Degree/Sec.</td>
<td>0.238 0.015</td>
<td>0.968 0.072</td>
<td>21.495</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>The size of the left ventricle in the diaphragm</td>
<td>Mm</td>
<td>126.5 0.83</td>
<td>127.8 0.73</td>
<td>1.22</td>
<td>0.1</td>
<td>Non sig.</td>
</tr>
<tr>
<td>The size of the left ventricle in contractions</td>
<td>Mm</td>
<td>42.1 0.95</td>
<td>43.3 0.88</td>
<td>1.67</td>
<td>0.06</td>
<td>Non sig.</td>
</tr>
<tr>
<td>Left ventricular wall thickness</td>
<td>Mm</td>
<td>10 0.47</td>
<td>12.2 0.74</td>
<td>4.13</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Below the level of significance (0.05) and the degree of freedom (7)

Table (1) shows the statistical indicators of the results of the tests in the Pre and Post measurement of the research variables that the members of the first experimental group underwent.

The results showed that the values of the computational circles were higher in the post-test than the Pretest, and there was a significant difference between the tests and for the post-benefit, as indicated by the levels of significance (0.05), indicating significant differences between the two tests.

As for the variables (size of the left ventricle in the contraction and incision), there were no significant differences between the tests of Pre and Post, which indicated the levels of significance, which was higher than the level of significance (0.05).

Table 2: Shows the level and type of significance of the second experimental group in the Pre and Post tests

<table>
<thead>
<tr>
<th>Tests</th>
<th>Units</th>
<th>Pretest</th>
<th>Posttest</th>
<th>(t)value</th>
<th>Level of significance</th>
<th>Type of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The explosive power of the arms</td>
<td>Watt</td>
<td>861.05 49.58</td>
<td>1203.05 12.55</td>
<td>20.230</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>The explosive power of the two legs</td>
<td>Watt</td>
<td>1272.17 14.75</td>
<td>1629.0 19.69</td>
<td>63.378</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Shooting skill of jumping high</td>
<td>Degree/Sec.</td>
<td>0.243 0.007</td>
<td>0.403 0.012</td>
<td>38.583</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
</tbody>
</table>
Conted…

<table>
<thead>
<tr>
<th>The size of the left ventricle in the diaphragm</th>
<th>Mm</th>
<th>127</th>
<th>0.59</th>
<th>128.1</th>
<th>0.82</th>
<th>1.54</th>
<th>0.07</th>
<th>Non sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The size of the left ventricle in contractions</td>
<td>Mm</td>
<td>42.8</td>
<td>1.2</td>
<td>43.7</td>
<td>1.5</td>
<td>1.72</td>
<td>0.06</td>
<td>Non sig.</td>
</tr>
<tr>
<td>Left ventricular wall thickness</td>
<td>Mm</td>
<td>10.2</td>
<td>0.56</td>
<td>13.1</td>
<td>0.80</td>
<td>5.12</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Table (2) shows the statistical indicators of the results of tests in the Pre and Post measurement of the research variables experienced by the members of the second experimental group.

The results showed that the values of the computational circles were higher in the post-test than the Pretest, and there was a significant difference between the tests and for the post-benefit, as indicated by the levels of significance Was less than the level of significance (0.05), which indicates the existence of significant differences between the two tests, and this is consistent with the second hypothesis of the research.

As for the variables (size of the left ventricle in the contraction and incision), there were no significant differences between the tests of Pre and Post, which indicated the levels of significance, which was higher than the level of significance (0.05).

The researchers attributed the reason for the development that happened to the members of the two experimental groups is regularity in the training process and work according to a systematic and organized by the researchers, as the exercises directed and mastered in terms of (intensity, size and density) using relative strength and absolute hierarchical method led to the development of explosive capability of both men and arms Which helped to control the performance of the correct motor paths, as well as increase the speed of performance and reduce the time and disposal of excessive random movements that existed because of failure to adjust the performance resulting from the weakness of the strength of the muscles of the arms and legs as the “ J for any sports game depends mainly on physical numbers “.5

In addition, the use of relative and absolute strength exercises in a hierarchical manner increased the working motor units and obtained neuromuscular adjustment, which was reflected in the development of strength and speed, in order to serve the skill performance.

The researchers also attributed the cause of significant differences in the thickness of the left ventricular wall. The difference between the left ventricular size and the contraction of the left ventricle was not significant. The effect of the muscular strength exercises was more likely to increase muscle size than the increased size of the cavity. The intensity of the effect on the ventricle varies from one sport to another and from one exercise to another, the size of the heart increases in the endurance players, an increase in the size of the left ventricle and not in the thickness of the muscle, unlike the muscular force players whose effect is reversed.

View and analyze the results of the measurement and discussion of the Post tests of the two research groups:

Table 3: Shows the level and type of significance between the results of the Post tests of the two groups of research

<table>
<thead>
<tr>
<th>Tests</th>
<th>Units</th>
<th>First experimental group</th>
<th>Second experimental group</th>
<th>(t) value</th>
<th>Level of significance</th>
<th>Type of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The explosive power of the arms</td>
<td>Watt</td>
<td>1588.20</td>
<td>1203.05</td>
<td>65.73</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>The explosive power of the two legs</td>
<td>Watt</td>
<td>1875.59</td>
<td>1629.0</td>
<td>7.12</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Shooting skill of jumping high</td>
<td>Degree/ Sec.</td>
<td>0.968</td>
<td>0.403</td>
<td>19.04</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
</tbody>
</table>
Conted…

<table>
<thead>
<tr>
<th></th>
<th>Mm</th>
<th>127.8</th>
<th>0.73</th>
<th>128.1</th>
<th>0.82</th>
<th>1.38</th>
<th>0.10</th>
<th>Non sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The size of the left ventricle in the diaphragm</td>
<td>Mm</td>
<td>43.3</td>
<td>0.88</td>
<td>43.7</td>
<td>1.5</td>
<td>1.22</td>
<td>0.12</td>
<td>Non sig.</td>
</tr>
<tr>
<td>Left ventricular wall thickness</td>
<td>Mm</td>
<td>12.2</td>
<td>0.74</td>
<td>13.1</td>
<td>0.80</td>
<td>3.95</td>
<td>0.02</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Below the level of significance (0.05), the degree of freedom (14)

By examining the results of the tests in Table (3), we find that there are significant differences between the measurement of the Post tests of the two groups in the variables (explosive power of the arms and legs and the accuracy of the Shooting accuracy of jumping high), and for the benefit of the first experimental group, The values of the significance level were less than the error level (0.05) and this is consistent with the second hypothesis of the research.

While the variable (thickness of left ventricle wall) showed that there was a significant difference between the measurement of the post-test of the two groups and the interest of the second experimental group that used the absolute force because the values of the level of significance was less than the level of error (0.05).

While the researchers attributed the reason why the second group superiority in the thickness of the wall of the left ventricle of the heart because of the nature of stress and severe pressure on blood vessels by the muscle fibers during the performance of such type of exercise, which leads to increased heart rate and systolic blood pressure more sharply and thus, (Hazaa Mohammed) showed that there was an increase in the heart mass resulting from the large increase in the thickness of the abdominal wall after direct muscle training. While the researchers attributed the reason why the second group superiority in the thickness of the wall of the left ventricle of the heart because of the nature of stress and severe pressure on blood vessels by the muscle fibers during the performance of such type of exercise, which leads to increased heart rate and systolic blood pressure more sharply and thus, (Hazaa Mohammed) showed that there was an increase in the heart mass resulting from the large increase in the thickness of the abdominal wall after direct muscle training.10

Conclusions

1. The exercises of absolute power in a hierarchical way to develop the explosive capability and the accuracy of the skill of the Shooting of the jump for young handball players.

2. The exercises of force percentage pyramid method is working to develop the explosive capability and the accuracy of the skill of shooting of the jump for young handball players.

3. The RSI exercises are better than the absolute power exercises in developing the explosive capability and the precision index for the skill of aiming from jumping to young handball players.

Ethical Clearance: Taken from University of Karbala, Iraq

Source of Funding: Self

Conflict of Interest: None

REFERENCES


Prevalence of Enteric Parasites in Raw Leafy Vegetables in Baghdad City, Iraq

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Lecturer, Department of Microbiology, College of Medicine, AL-Mustansiriyah University

ABSTRACT

Background: The eaten raw vegetables have been demonstrated to be a vehicle for transmission of a range of parasites. Various parasites that have been associated with vegetables include species of protozoan and helminthes. To our knowledge no previous surveys have been conducted to evaluate the prevalence of parasitic contamination of vegetables in Baghdad. Therefore, this study aimed to detect the parasitic contamination in some common raw vegetables in Baghdad, Iraq.

Materials and Method: A cross sectional study conducted in Baghdad city for one year (from February 2012 till February 2013). Iodine staining of wet mount preparation was performed to identifying the enteric parasites in a 360 samples of leafy vegetables that commonly eating raw as salad.

Results: 112 (31.1%) were positive samples for enteric parasites out of the 360 samples of leafy vegetables that was examined by this study. Celery and lettuce recorded the highest prevalence of 28.6%, 25.9% respectively, followed by cress 19.6% and parsley 16.9%, while radish and spearmint had the least prevalence of 6.3% and 2.7% respectively. The statistical analysis indicated that the cysts of Entamoeba histolytica (22.3%), eggs of Ascaris lumbricoides (20.5%) and cysts of Giardia lamblia (17.0%) were the most isolated parasites. Seven other species of parasites were also isolated from these leafy vegetables. They were include eggs of Echinococcus (8.9%), oocysts of Toxoplasma gondii (7.1%), eggs of Ancylostoma duodenale (6.3%), eggs of Fasciola hepatica (6.3%), eggs of Strongyloides stercoralis (4.5%), eggs of Trichuris trichiura (4.5%)

Conclusion: Enteric parasites heavily contaminating the leafy vegetables in Baghdad city

Keywords: Enteric parasite, raw leafy vegetables, leafy vegetables, Baghdad.

Introduction

Healthy human diet owing to their nutritional value must contain vegetables as an essential part. Fresh vegetables are main source of dietary fiber, vitamins and minerals. (1) For optimal nutritional value, some vegetables are eaten uncooked as salad within the daily meals to keep the natural taste and preserve heat labile nutrients. Ingestion of raw vegetables represented an important mean of transmission of several infectious diseases because of their complex surface and porosity, which unfortunately facilitate pathogen attachment and survival. (2) Food- and waterborne infections have received considerable attention in the last decade. Some of these infections are well recognized, but are considered emerging because they have recently become more common. (3) Globalization of the food supply, increased international travel, increase of the population of highly susceptible persons, change in culinary habits, but also improved diagnostic tools and communication are some factors associated with the increased diagnosis of foodborne parasitic diseases worldwide. (4) Leafy greens are grown close to the ground and the leaves can become contaminated in the field by soil, contaminated water, wild and domestic animals or improperly composted manure. Pathogens may also be transferred during and after harvest from handling, storing and transporting (5)

Prevalence of different stages of parasite in raw eaten vegetables as the source of contamination may be remarkable indicator about the incidence of enteric parasites among a given community. The great source for transmission of parasitic contamination is the ingestion of not well washed leafy vegetables. The degree of contamination differed according to the type of vegetable examined and the species of parasite was also indicated by these studies. The previous surveys showed that the vegetables can be agents for transmission of
protozoan cysts and oocysts of *Entamoeba, Giardia, Cryptosporidium, Toxoplasma, Cyclospora* and *Isospora* and helminths eggs and larvae of *Hymenolepis, Taenia, Fasciola, Toxocara, Ascaris, Trichostrongylus, Strongyloides* and. (6-12)

**Materials & Method**

**i. Sampling of Vegetables:** A total of 360 leafy vegetables that are commonly eaten raw include celery (*Apium graveolens*) (70 samples), lettuce (*Lactuca sativa*) (70 samples), cress (*Lepidium sativum*) (70 samples), parsley (*Petroselinum crispum*) (70 samples), radish (*Raphanus sativus*) (40 samples) and spearmint (*Mentha spicata*) (40 samples) were chosen for the study as the majority of the population in our community consumes them on a daily basis diet. Vegetables were collected from retail markets located in different parts in Baghdad city. The vegetables were planted in or around Baghdad city. From retail sellers in vegetable markets the samples were randomly collected and bought from those sellers at different monthes of the year (90 samples in each of summer, autumn, winter and spring) in the period from February 2014 till February 2015.

**ii. Detection of intestinal parasites:** About (150 g) of each sample was chopped into small pieces and washed with physiological saline solution (0.95% NaCl). For natural sedimentation, the washing liquid was left overnight, after removing bits of leaves a volume of 300 ml of supernatant was discarded and the remainder was transferred to 10 ml test tubes and centrifuged at 2000 g for 20 min. The supernatant was discarded and the sediment was then stained with iodin, examined under a light microscope (x100- x400 and oil immersion power). According to Soulsby, 1982 the stages of parasites (cysts, oocysts, eggs or larvae) were identified. (13) In each positive sample for parasites stages, the number was counted and the developmental stage and the type of parasites were recorded.

**iii. Statistical Analysis:** By using the statistical software SPSS, a comparisons between different groups was performed. For multiple comparisons, Pearson Chi square test was used between rates of parasites identified in different seasons of the year and p<0.05 were considered significant.

**Results**

Enteric parasites were detected in 31.1% (112 out of 360) of the six examined leafy vegetables samples (Table 1). The examined vegetables collected from retail seller in Baghdad were found to be highly significant (P-value = 0.0001) contaminated with one or more enteric parasites. Celery was more likely to be contaminated with enteroparasites 28.6% (32 out of 112 total contaminated), which it was not significantly higher than the contamination rate found in lettuce 25.9% (29 out of 112). The contamination rate in celery and lettuce, were found to be significantly higher than in cress 19.6% (22 out of 112), parsley 16.9% (19 out of 112), radish 6.3% (7 out of 112) and spearmint 2.7% (3 out of 112). Low contamination level was found in radish and spearmint.

**Table 1: Prevalence of enteric parasites contaminating different types of raw leafy vegetables**

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Positive Samples</th>
<th>Negative Samples</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Celery</td>
<td>32</td>
<td>28.6 (45.7)</td>
<td>38</td>
</tr>
<tr>
<td>Lettuce</td>
<td>29</td>
<td>25.9 (41.4)</td>
<td>41</td>
</tr>
<tr>
<td>Cress</td>
<td>22</td>
<td>19.6 (31.4)</td>
<td>48</td>
</tr>
<tr>
<td>Parsley</td>
<td>19</td>
<td>16.9 (27.2)</td>
<td>51</td>
</tr>
<tr>
<td>Radish</td>
<td>7</td>
<td>6.3 (17.5)</td>
<td>33</td>
</tr>
<tr>
<td>Spearmint</td>
<td>3</td>
<td>2.7 (7.5)</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>112</td>
<td>31.1</td>
<td>248</td>
</tr>
</tbody>
</table>

P value = 0.0001 (Highly significant using Pearson Chi-squared test at 0.05 level.

Table 2 shows the distribution of parasites detected in raw leafy vegetables collected from markets. Ten species of parasites were found to be responsible for contamination. *Entamoeba histolytica* was the most...
common parasite detected 25 (22.3%), followed by *Ascaris lumbricoides* 23 (20.5%), *Giardia lumblia* [19 (17.0%)], *Echinococcus* 10 (8.9%), *Toxoplasma gondii* 8 (7.1%), *Ancylostoma duodenale* 7 (6.3%), *Fasciola hepatica* 7 (6.3%), and then *Strongyloides stercoralis* 5 (4.5%), *Trichuris trichiura* 5 (4.5%) then finally *Hymenolepis nana* 3 (2.6%).

In celery, lettuce and cress the ten species of enteric parasites were detected within it, while radish was found to be contaminated with (*Entamoeba, Ascaris, Giardia* and *Echinococcus*), and in spearmint was found to be contaminated with (*Entamoeba, Ascaris, and Giardia*).

### Table 2: The types of enteric parasites that contaminated raw leafy vegetables

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Paratypes</th>
<th>No</th>
<th>%</th>
<th>No</th>
<th>%</th>
<th>No</th>
<th>%</th>
<th>No</th>
<th>%</th>
<th>No</th>
<th>%</th>
<th>No</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Celery</td>
<td><em>Entamoeba histolytica</em></td>
<td>7</td>
<td>28.0</td>
<td>6</td>
<td>24.0</td>
<td>4</td>
<td>16.0</td>
<td>4</td>
<td>16.0</td>
<td>3</td>
<td>12.0</td>
<td>1</td>
<td>4.0</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td><em>Giardia lumblia</em></td>
<td>5</td>
<td>26.3</td>
<td>5</td>
<td>26.3</td>
<td>4</td>
<td>21.0</td>
<td>3</td>
<td>15.8</td>
<td>1</td>
<td>5.3</td>
<td>1</td>
<td>5.3</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td><em>Toxoplasma gondii</em></td>
<td>2</td>
<td>25.0</td>
<td>1</td>
<td>12.5</td>
<td>2</td>
<td>25.0</td>
<td>3</td>
<td>37.5</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td><em>Ancylostoma</em></td>
<td>2</td>
<td>28.6</td>
<td>2</td>
<td>28.6</td>
<td>1</td>
<td>14.2</td>
<td>2</td>
<td>28.6</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td><em>Ascaris lumbricoides</em></td>
<td>6</td>
<td>26.1</td>
<td>6</td>
<td>26.1</td>
<td>5</td>
<td>21.7</td>
<td>3</td>
<td>13.0</td>
<td>2</td>
<td>8.7</td>
<td>1</td>
<td>4.4</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td><em>Strongyloides stercoralis</em></td>
<td>1</td>
<td>20.0</td>
<td>1</td>
<td>20.0</td>
<td>1</td>
<td>20.0</td>
<td>2</td>
<td>40.0</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><em>Trichuris trichiura</em></td>
<td>2</td>
<td>40.0</td>
<td>0</td>
<td>40.0</td>
<td>1</td>
<td>20.0</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><em>Fasciola hepatica</em></td>
<td>3</td>
<td>42.8</td>
<td>2</td>
<td>28.6</td>
<td>1</td>
<td>14.1</td>
<td>1</td>
<td>14.2</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td><em>Echinococcus</em></td>
<td>3</td>
<td>30.0</td>
<td>3</td>
<td>30.0</td>
<td>2</td>
<td>20.0</td>
<td>1</td>
<td>10.0</td>
<td>1</td>
<td>10.0</td>
<td>0</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><em>Hymenolepis nana</em></td>
<td>1</td>
<td>33.3</td>
<td>1</td>
<td>33.4</td>
<td>1</td>
<td>33.4</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>

**P-value**: = 0.001 (Highly significant using Pearson Chi-squared test at 0.05 level.

Comparing the rate of parasitic contamination in the four seasons, a significant difference is seen as indicated by table 3. It was found that the number of contaminated samples in spring was higher than the number of contaminated samples in summer, autumn and winter. The highest rate of parasitic contamination in vegetable samples in different seasons was found in spring 31.2% (35 out of 90 samples), followed by summer 26.8% (30 out of 90 samples), autumn 23.2% (26 out of 90 samples) and in winter 18.8% (21 out of 90 samples).

### Table 3: Prevalence of enteric parasites at different seasons

<table>
<thead>
<tr>
<th>Examined Samples</th>
<th>Positive Samples</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Spring</td>
<td>90</td>
<td>35</td>
</tr>
<tr>
<td>Summer</td>
<td>90</td>
<td>30</td>
</tr>
<tr>
<td>Autumn</td>
<td>90</td>
<td>26</td>
</tr>
<tr>
<td>Winter</td>
<td>90</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>360</td>
<td>112</td>
</tr>
</tbody>
</table>

**P-value** = 0.017 (Significant using Pearson Chi-squared test at 0.05 level.

### Discussion

People have been urged to eat lots of raw (fresh) vegetables for a healthful diet, and these vegetables can serve as truck of transmitting enteric parasitic pathogens throughout the process of planting to eaten by human. (10) The vegetables require a moist environment for their growth; these conditions favor the development of transmissible forms of enteroparasites such as eggs, larvae, cysts and oocysts. (14)

Many previous local (9,12,15) and global (6-12) studies as well as the recent study indicated high rate contamination of different types of raw vegetables with one or more kind of parasites. Several factors may account for the high prevalence of intestinal parasites contamination recorded in most of the analyzed vegetables (although not directly reported). The use of polluted water for irrigation of implanted leafy vegetables and the use of fresh poultry manure as fertilizer may be an important factors in spreading of enteroparasites, because both the irrigation water and the manure are applied on top of the crops. Lacking the supplement for better sanitary standards (e.g., clean water for crop washing and refreshing) and market-related handling are another sources of contamination. (16) Associated with
raw water reuse in irrigation of vegetables was reported by many epidemiological studies as other factor led to excess of parasitic contamination. \(^{(17)}\)

The present study may in agreement or in disagreement with the previous studies in mater of the type of vegetable with high rate of contamination and the species of parasites that commonly contaminated these vegetables. The study revealed that the enteroparasites contaminating celery and lettuce was significantly higher than in cress, parsley, radish and spearmint. This finding is in agreement with that reported by other investigators. \(^{(6-8)}\) This could be due to the fact that the degree of contamination varies according to the shape and surface of vegetables. The presence of trichomes on the surface of irregular leaves of green leafy vegetables as lettuce, rocket and parsley have uneven surfaces and makes parasitic eggs, cysts and oocysts attached to the surface of the vegetable more easily, either in the farm or when washed with contaminated water. On the other hand, vegetables with smooth surface as leek and green onion had the least prevalence because its smooth surface reduces the rate of parasitic attachment. \(^{(11)}\) The morphology of the celery, cress radish and mint leaves overlapping on each other, protecting the eggs of helminthes against conditions unfavorable to their survival and persistence, such as sunlight, desiccation, and wind. \(^{(18)}\)

Regarding the kinds of enteric parasites that contaminating these vegetables, the study showed that \textit{Entamoeba histolytica} (22.3%), \textit{Giardia lumibia} (17.0%) and \textit{Ascaris lumbricoides} (20.5%) were the most common isolated parasites. The result of this study is compatibles with the results obtained by many researchers. \(^{(9,10,12)}\) The enteric parasites that recovered from vegetables of spring were significantly higher than the enteric parasites that recovered in other seasons. The high recovered rate of enteric parasites in spring was found to be followed in descending manner by summer, autumn and winter. High prevalence of enteroparasites in warm seasons indicating by the recent research is in agreement to that reported by other workers. \(^{(7,9)}\) In warm seasons, the expelling of parasite’s eggs to environment by human or animals is high comparing to cold seasons. \(^{(19)}\)

Vegetables, and especially salads, are an important route of transmission of intestinal parasites and have been shown to be an important source of food borne outbreaks in developing countries. \(^{(20)}\) The most likely hypothesis of contamination is that it occurred before harvest, either by contaminated manure, manure compost, sewage sludge, irrigation water, runoff water from livestock operations or directly from wild and domestic animals. These potential contamination events are all plausible and consistent with the assumption that the level of contamination must have been high. \(^{(21)}\)

An accepted and expected difference is observed between the recent study and those reported by other works in prevalence rates of the different pathogenic enteric parasites from fresh vegetables. Factors may lead to such differences may include, geographical location of implantation, type and number of samples examined, methods used for detection of the intestinal parasites, type of water used for irrigation, and post-harvesting handling methods of such vegetables, in addition to many other factors.

**Conclusion**

Enteric parasites heavily contaminating the leafy vegetables in Baghdad city, therefore the public enlightenment campaign on the danger of consuming of such products is highly needed in our community

**Conflict of Interest:** There is no conflict of interest by the authors

**Source of Funding:** Self

**Ethical Clearance:** Taken from the scientific committee of the Iraqi Ministry of health

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Histopathological and Molecular Study of *Raillietina echinobothrida* of Domestic and Wild Pigeons in Al-Muthanna Province

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**ABSTRACT**

This study was conducted to detect and distinguish *Raillietina echinobothrida* of domestic and wild infecting pigeons has been based on morphology, histopathological and molecular analysis. The present study was conducted on 115 pigeons (73 of S. Decaocto and 42 of C. livia) of different age groups and of both sexes. The results of the present study were revealed that only 86 out of 115 examined pigeons were infected by *Raillietina* spp at infection rate of 74.78%. Besides, the percentage of infection with *Raillietina* spp were recorded in S. Decaocto is higher than C. livia in 44.34% and 30.43% respectively. The most isolated parasites of examined birds were showed the cestoda *R. echinobothrida* with total number (168) adult worms from total number of examined pigeons infected (115). The histopathological examination of small intestine of pigeons infected with *R. echinobothrida* were showed different changes like, an infiltration of inflammatory cells in lamina properia and atrophy of villa of small intestine with vaculation of muscularis externain and loss of mucous membrane. The result of PCR were showed that specific primers (3S-F, BD2-R) were successfully for amplifying 944 bp with flanking region of ITS2 to *R. echinobothrida*. Also, the PCR result were revealed that 61 (70.93%) out of 86 birds were positive to *R. echinobothrida*.

**Keywords:** *R.echinobothrida*, domestic and wild pigeons, Pathological, Molecular, Iraq

**Introduction**

Iraq has a wide range of geological diversity from the peaks of Kurdistan Mountains in the north to the deserts and semi-deserts in the west and the great marshes in the south, these contribute to the wide biological as well as faunal diversity¹.

In recent years, poultry farming has tremendously developed and become one of the most intensive forms of animal husbandry activities². The Domestic pigeon (Columbia livia) is one of the commonest birds and tend to be closely contact with humans and birds as a source of protein, hobby, and recently as laboratory animals tend to be closely contact with humans and birds as a source of protein, hobby, and recently as laboratory animals³,⁴.

Parasitic infections cause great economic losses to poultry in our country, the birds are under constant stress and are prone to parasitic infections⁵. Endoparasite of poultry are common in the tropical and sub-tropical where the standard of husbandry is poor and climatic conditions are favorable for their existence⁶,⁷.

*Raillietina echinobothrida* is consider the most pathogenic and prevalent species infecting birds throughout the world⁸,⁹. This parasite inhabits in the jejunum and ileum of the definitive host, from where it obtains nutrition from the digested food of the host, whereas their larval stage (cyticercoid) resides in various invertebrate intermediate host, such as ants, beetles, small mini-wasps, or termites for completion of its life cycle. *R. echinobothrida* is a hermaphrodite worm having both the male and female reproductive organs in its body¹⁰,¹¹.
R. echinobothrida is responsible for ‘nodular tapeworm disease’ in poultry and retarded growth of young birds, emaciation of adult and low egg production of hen, disrupt gastrointestinal tract digestion decrease in consumption of fodder and intestinal obstruction can occur in heavy infection\textsuperscript{12}. In addition, this tapeworm does not cause gross pathological damages on well-nourished bird in the light infection, but do compete for food when they large numbers of parasites. If the heavy infection becomes, marked severe lesions on the intestinal walls due to the scolexs are penetrate the mucosal layer and causes characteristic hyperplastic enteritis associated with the formation of granuloma (nodules contain cheesy and calassified material) on the intestinal wall of the infected birds and diarrhea could arise, which ostensibly resulted in ill health\textsuperscript{11,13}.

The taxonomy of Cyclophyllidea traditionally depends upon the accurate descriptions of small differences in the size and shape of the scolex, rostellum (unarmed or armed with rows of hooks) suckers and gravid proglottids\textsuperscript{9}. Nevertheless, with a rich resource of bourgeoning data the molecular approach is proving to be more rapid, sensible and reliable than that based on morphological data alone for phylogenetic analysis\textsuperscript{14}. The objective of the present study was to study and recognize the histopathological changes result of the invasive R. echinobothrida in the small intestine, supplementing the morphological observation, also confirmed the diagnosis of R. echinobothrida in the birds by the molecular diagnostic PCR technique.

**Materials and Method**

**Study Area and Sampling:** A total number of 115 pigeon samples (73 of *Streptopelia Decaocto* and 42 of *Columba livia*) of different age groups and of both sexes were collected randomly selected from Samawah markets in Muthanna province, south of Iraq. The process of collecting pigeon samples were extended during the period from February to September 2017.

**Samples Collection and Parasitological Examinations:** Postmortem examinations were performed according to\textsuperscript{15}. Occasionally, cestoda were very adherent to the intestines that have been cut off with the intestine wall then preserved them in hot water till passive separation\textsuperscript{16}. The worms were preserved in 4% formalin according to\textsuperscript{17}.

**Histopathological Examinations and DNA Extraction:** A pieces of intestines from the infected pigeons were collected. A histological study was conducted according to\textsuperscript{18}. The Mini Kit DNAQIAmp/QIAGEN/Germany were using to isolate genomic DNA from adult worm according to [19]. The PCR program were performed of 94C\textdegree at 2 min followed by 35 cycle of 94C\textdegree for 1min, 57C\textdegree for 1min and 72C\textdegree for 1min, this was followed by a final extension step at 72 \textdegree C for 7 min\textsuperscript{19}.

**Results**

The results of the present study were revealed that only 86 out of 115 examined pigeons were infested by Raillietina spp during the study period from February to May 2017 at infestation rate of 74.78\% (86/115). Also, the result were showed that both S. adecaocto and C. livia (males and females) were infested with different the species of Raillietina. The number of Cestoda which were isolated from each bird may be reach to 5-7 worms. Furthermore, the percentage of infection with Raillietina spp were recorded in S. decacocto is higher than C. livia in 44.34 \% (51/115) and 30.43\% (35/115) respectively.

The histopathological examination of small intestine of pigeons infected with *Raillietina echinobothrida* were characterized by varying degrees of degenerative changes to destruction and sloughing of epithelial layer of intestinal mucosa in heavy infections as showed in figure 3. Also, the results of this examination were showed different pathological changes like, desquamation, destruction and loss of mucous membrane of villi as showed in figure 4.

Fig. 1: *Raillietina echinobothrida* worm with alum carmine stain, Scolex
Fig. 2: *Raillietina echinobothrida* worm with alum carmine stain, Graved segment with egg capsules.

Fig. 3: Small intestine of pigeons infected with *Raillietina echinobothrida* showed destruction and sloughing of epithelial layer of intestinal mucosa in heavy infections.

Fig. 4: Small intestine of pigeons infected with *Raillietina echinobothrida* showed destruction and desquamation of villi.

Fig. 5: Small intestine of pigeons infected with *Raillietina echinobothrida* showed infiltration with heterophils throughout the mucosa, especially in the lamina propria.

Fig. 6: Agarose gel electrophoresis of amplified DNA of *R. echinobothrida* by using primers (3S-F, BD2-R) region of region of 28S, Lane L DNA ladder, Lanes 1,2,3,4, positive to 944 bp.

**Discussion**

The result in the present study were revealed that only 86 out of 115 examined pigeons were infested by *Raillietina* spp during the study period from February to May 2017 at infestation rate of 74.78% (86/115). Also, the results in this study were recorded and confirm that *Raillietina* spp spread throughout the months of the year with high prevalence. This result agreed with most studies as [21,22, 23, 24]. But, this result was disagreed with [25, 26] who reported rate of infection 25.3%, and 17.4% respectively.

In addition, the spread of tapeworms and presence in all seasons of the year is the result of a natural of life cycle of the tapeworm that transmitted from birds to another through contamination feed and water with mature segment led to easily spread between birds [24,27,28]. Finally, there are many studies confirm that changes in the climate factors like temperature or humidity had no directly effect...
in incidence infection and severity, therefore Raillietina spp is found in all months the year\textsuperscript{24,29}.

The results were agreement with many previous studies\textsuperscript{31,32,33} and disagreement with\textsuperscript{34}. This agreement between the studies were recorded that the male’s bird were more infected than females may be because consuming greater quantities of food as result to fly away from the nest and for long distance, While, the females remains near the nest near her eggs. Also, the females are concentrated in the food on the limestone material that need in building egg shells which reduce the handling of food\textsuperscript{31,32,35}.

The duodenum and jejunum cavities of Raillietina spp infested birds was congested and filled with greenish or yellowish feces with a very soft to liquid consistency and containing much mucous exudate. In cases with a heavy infection of parasites the mucosa was thinned and also revealed hemorrhagic spots. These finding are agreement with other studies\textsuperscript{24,26}. The explanation of results the gross examination in the present study is attributed to the adhesion site of adult worms in the small intestine by scolex and change this location in wall of intestine continuously and the worms migrated up and down the intestinal lumen away from the congestion to get nutrition when present in large numbers and also aggregate in the lower half of the intestine. Moreover, probably this lesion is results from anther secondary bacterial infection in the intestine due to destruction of intestinal epithelium by parasites, hemorrhage have been noticed in others may be due to irritation of heavy infection\textsuperscript{28}.

On the other side, the histopathological examination of the small intestine of pigeons infected with Raillietina echinobothrida were showed necrosis of villous epithelium, massive hemorrhages and infiltration of inflammatory cells in the lamina propria and sub mucosa. These results are agreement with previously studies\textsuperscript{24,28}. Each parasite have a degree of adverse impact on host and may be a change in texture of tissue, or take change in overall impact. The parasites occurs a damage to their hosts like; injurer and metabolic outcomes affecting enzymes and hormones of the host or consume food the host\textsuperscript{31,36}.

Also In the present study the reason to chosen these sets of primers may be attributed to the constancy and stability of the second internal transcribed spacer (ITS2) region of ribosomal DNA gene makes them a prominent target for species variation. In addition, the gene sequences of these locations have been developed for molecular phylogenetic studies\textsuperscript{38}.

Acknowledgments

The authors are grateful to Departments of Veterinary Microbiology and Parasitology, College of Veterinary Medicine, Al-Muthanna University- Iraq for providing the facilities.

Conflict of Interest: This research is a personal non-profit work and there is no conflict of interest.

Source of Funding: None.

Ethical Clearance: Ethical clearance was obtained from the Faculty Scientific Committee (Department of Anatomy College of Veterinary Medicine/AL Muthanna University/Iraq,) to study the histopathological and molecular of Raillietina echinobothrida of domestic and wild pigeons in Al-Muthanna Province

REFERENCES


Female Infertility: A Systematic Review of the Literature

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ABSTRACT

Due to wars in Iraq, since 1990 and after 2003, the Iraqi environment suffered from acts of profanation. A large number of injuries and deaths were caused by destructive chemicals and radioactive materials. These events resulted in either cancer or infertility. Infertility is one of the medical, social and psychological burdens in Iraqi society. It is defined as “the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse. Induction of ovulation has remained a milestone in the women treatment anovulatory infertility.

Keywords: Women infertility, gonadotropin

Introduction

Infertility according to World Health Organization WHO, is defined as a disease of the reproductive system, by the failure to achieve clinical pregnancy after 12 months or more of regular unprotected sexual intercourse (¹). The inability to become pregnant results in important affecting and profitable tolls, among that artificial nervousness and sadness are more common in infertile couples than fertile couples, also Assisted Reproductive Technologies ART are accessible to care for sterility, but these are pricey. In the last thirty years, Iraq exposed several instability crises causes exasperation in many health problems. One of these problems was the fertility status of many people all over the country. Few studies deal with this health problem in spite of the mental, communal and fiscal proportions of this subject (²). Infertility can be caused due to many medical disorders, may be due to fallopian tube injury, fertilization and ovulation interference or also hormonal turbulence (³). Unable or difficult to conceive is a physically and psychologically painful condition in a female’s life (¹).

The Female Reproductive System: The most important organs and structures in the reproductive system is the uterus, it is a vacant muscular organ and pear-shaped organ located between the bladder and lower intestine. It consists of two parts, the cervix and the body; cervix is the uterus lower portion. The os opening is the vessel opening which opens into the vagina and helps the flow out of the menstrual blood from uterus to vagina and leading off the uterus into two fallopian tubes. Next to this is ovary which closes each tube stages. The egg producing organ known as ovary contains 200,000 to 400,000 follicles (⁴) (Figure1).

Figure 1: The reproductive system of women (⁴)

Type of Infertility: Infertility may be primary or secondary. Primary infertility refers to couples who
have never conceive after a minimum of 1 year of attempting to do so through unprotected intercourse and the live birth absence in non-contraception sexually active woman (5) whereas, secondary infertility refers to couples who are unable to conceive after one year of unprotected intercourse following previous pregnancy and not using any contraceptives and as the inability to conceive despite exposure to pregnancy for one year (2 years in some epidemiological studies), after having conceived at least once before (6). Secondary infertility owed to the failure to become pregnant pregnancy failure to a live birth following either a preceding pregnancy or a preceding gift to bear a pregnancy to a live birth(7).

**Diagnosis of Infertility:** Infertility diagnosis is within 1 year failed to conceive and is argued to increase the infertility risk since women about 50% failed to conceive in first year may also do so in second year (8).

**Female Infertility Causes:** Infertility in female may be caused due to variable factors:

**Disorders of Ovulation:** The (WHO) classifies ovulation disorders into three groups:

Group I: hypothalamic pituitary failure (hypothalamic amenorrhea or hypogonadotropic and hypogonadism).

Also called as hypogonadotropichypogonadism, may be caused due to failure of hypothalamic pituitary. With these conditions generally women are having amenorrhea (primary or secondary), also may be known as hypothalamic amenorrhea, estrogen deficiency and low gonadotrophins levels low gonadotrophins levels are the main characteristics (9).

Group II hypotalamic-pituitary-ovarian dysfunction, predominately a product of polycystic ovary syndrome (PCOS).This is the cause of the enormous greater part of ovulation disorder.

Group III: ovarian failure a result hypo-thalamic cause body mass index (BMI) over 35 (Kg/). BMI will result in irregular menses, amenorrhea, or failure to ovulate and increase in pituitary hormones (FSH and LH) will result in failure to ovulate(10).

**Male Factor:** Male infertility is diagnosed when, after testing both partners, reproductive problems have been found in the male (11). The first and most common test used to evaluate male infertility is semen analysis. Semen analysis includes a set of descriptive measurements of sperm parameters such as concentration, motility and morphology and some seminal plasma characteristics (12). For infertility in males there are six main causes. Abnormal sperm production or function is the first one. Due to repeat infections sperm can be affected, undescended testicles or genetic defects (13). Male factor infertility is assessed based on the following values (15).

- Underprovided sperm count (less than 10 million per milliliter; volume should be 1 - 5 ml. of ejaculate).
- Deficient sperm motility (over 60% should be motile and show purposeful forward movement).
- Poor sperm morphology (more than 50-60% abnormal in form). On the physical examination, testicular abnormalities such as a varicocele or absence of the vas deferens can be detected.

**Unexplained Infertility:** Unexplained infertility, referring to the failure to conceive of a couple in whom no definitive cause for infertility can be found, has an incidence of 10-20% in all infertile couples (14). Unexplained infertility diagnosis is given when evaluation of standard fertility is normal in both woman and man and it relies upon nature, number and quality of used tests and made conclusions (15). The principal treatments for unexplained infertility include expectant observation with timed intercourse and lifestyle changes, clomiphene citrate and intrauterine insemination (IUI), controlled ovarian hyperstimulation (COH) with IUI, and IVF (14).

**Recurrent Miscarriage:** Recurrent miscarriage defined as the loss of three or more consecutive pregnancies affects 1% of couples trying to conceive. It has been estimated that 1–2% of second-trimester pregnancies miscarry before 24 weeks of gestation (16). Two consecutive miscarriages are experienced by less than 5% of women, and three or more consecutive miscarriages by about 5% women. Subdivision of recurrent miscarriage can be done into primary and secondary recurrent miscarriage, the heterogeneity of this population is potentially reduced (17). After a positive urinary human chorionic gonadotropin (hCG) a pregnancy loss occurs or a serum β-hCG raised level before histological verification or ultrasound is called as a ‘biochemical loss’. Generally it occurs 6 weeks before gestation. Clinical miscarriage term is used when histological evidence or examination of ultrasound has confirmed that an intrauterine pregnancy has existed (18).
Endometriosis: Endometriosis is an estrogen-dependent chronic inflammatory condition that affects women in their reproductive period and is associated with women infertility and pelvic pain (19). A chronic condition Endometriosis is characterized by the endometrial tissue growth leaving the uterine cavity, generally in the pelvic cavity, including the endometrial deposits and ovaries, in ovary known as endometriomas. Tubal damage can be due to endometriosis, symptoms also include painful periods, pelvic pain, and during and after intercourse the pain (20). Endometriosis patients mainly complain of dysmenorrhea, dyspareunia, pelvic pain. The symptoms can affect the patient’s mental, social, physical, general, well-being (21).

Uterine or Cervical with the Fallopian Tubes Causes: Sperm-egg binding, sites are fallopian tubes and normal functioning of them serves natural conception prerequisite. Fallopian tubes obstruction is a common disease and may be main cause of infertility. Inflammation generally causes the obstruction of fallopian tubes and reproductive system infection, generally in infection sources items (22). There are several congenital or acquired uterine disorders, which cause infertility in the females; the acquired uterine abnormalities that are responsible for female infertility include polyps, some types of fibromas, adenomyosis, and some endometrial disorders such as intrauterine adhesions (23).

Hormonal Causes of Female Infertility

Ovarian Insufficiency: The average age of menopause is 51, with some women having their last period in their forties and others later in their fifties. A cessation of ovulation prior to the age of 40 is rare and is usually referred to as premature ovarian failure (24). Primary ovarian defect is premature ovarian failure (POF) described as absent menarche (primary amenorrhea) or ovarian follicles premature depletion before 40 years age (secondary amenorrhea). It is a diverse disorder affecting women of <40 years about approximately 1%, of age 20 1:10,000 women and of age 30 1:1,000 women. With absent pubertal development the most severe forms are present and primary amenorrhea (ovarian dysgenesis 50% cases), whereas post-pubertal onset forms are defined by the menstrual cycles disappearance (secondary amenorrhea) premature follicular depletion associated (25).

Luteal Phase Deficiency: The luteal phase defect is, by definition, a corpus luteum defective in progesterone production. As indicated by histochemical evidence, in the corpus luteum, estrogen is produced by the luteinized theca cells. The estrogen-producing function of the corpus luteum seems to be unimpaired in this disorder. The clinical manifestations of the defect include infertility and repeated first-trimester abortion (26). Hormonal imbalances have been associated with female infertility. The increased or decreased levels of FSH, LH and prolactin hormones may cause infertility (27).

Polycystic Ovarian Syndrome: Polycystic Ovarian Syndrome (PCOS) is the most common endocrine disorder affecting women of reproductive age and is closely associated with insulin resistance, metabolic syndrome and future risk of developing diabetes and cardiovascular disease (28). Anovulatory infertility’s PCOS is the major cause, but ovulation failure leaving other factors contributes to impairment in reproductively. Polycystic ovaries generally occur in ovulatory women having unexplained or tubal infertility (with around 50% prevalence) than in the general, (20%) population which is age-matched. This phenomenon considers that circulating hormones abnormalities (such as LH and serum testosterone elevated concentration) which is present in ovulatory women having polycystic ovaries are connected to social group distinctions compromised maturation.

Thyroid Disorders: Both hyper and hypothyroidism may result in menstrual disturbances. The most common manifestation is simple oligomenorrhea (decreased menstrual flow). Anovulatory cycles are very common. Increased bleeding may occur, but is rare in hyperthyroidism (23). The thyroid is an important endocrine gland and its dysfunctions interfere with numerous aspects of reproduction and pregnancy (29). In women of reproductive age, thyroid dysfunction can lead to a variety of gynecological disorders ranging from menstrual irregularities to infertility arising from many different pathophysiological mechanisms (30). Hypothyroidism is a leading cause of difficulty in achieving and maintaining pregnancy. Low thyroid function has a negative impact on reproductive health and is more common than most women realize (27). It is also linked with menstrual problems and a lack of ovulation in some cases. It can occur spontaneously, develop during or after pregnancy, or after treatment for hyperthyroidism (30).
External Causes of Female Infertility

Contraception: There is extensive use of contraceptives, generally by young individuals whose years of reproduction commonly lie in front of them. Use of various types of contraceptive varies with marital status reproductive history, race, and age (45). The return of fertility for women who discontinue oral contraceptives takes longer as compared with women who discontinue other methods of contraception (17). For contraception there is no perfect method and each method is having advantages and disadvantages balance. Ideal contraceptive characteristic method are: highly cheap; independent of intercourse effective; no side effects or risks; and no regular action is required on the users part; and acceptable to all cultures and religions and having non-contraceptive benefits (19).

Sterilization: For reversal of contraceptive sterilization in women, in determining whether fertility can be restored, several factors are important: length of tube remaining, tubal site, the surgical method initially used, and surgical skill in restoration. Some form of periodic abstinence is used, suppositories, douche, withdrawal, foam, were also used by women in small percentages (40). Female sterilization is a permanent procedure to prevent pregnancy. It works by blocking the fallopian tubes. When women choose have not children (29).

Abortion: Abortion means the termination of pregnancy before the fetus reaches viability Abortion is frequently stated that a high proportion of women who have an induced abortion by dilatation and curettage are subsequently infertile (29). Individuals without the requisite skills every year performs about 19–20 million abortions or in below minimum medical standard environments, or both. In developing countries nearly all unsafe abortions (97%) occur (22).

Drugs and Environment: Currently, reproductive risks no reliable estimates can be made from environmental factors. Before now, less attention was paid to drug-induced and environmental infertility and sub infertility. However, four health hazards dibromochloropropane, ethylene oxide, ionizing radiation, lead are regulated in part because reproductive system effects. Environmental hazards in general include chemical agents; physical agents such as temperature, altitude, and radiation; and alcohol consumption, smoking, like personal hobbits, use of drugs (both nontherapeutic and therapeutic), and patterns of eating. Drugs affect the fertility (24).

Diagnosis of Infertility: The most common examination for diagnosis of infertility is (26):

Couple’s history, physical exam, semen analysis, basal body temperature charts and menstrual cycle mapping, hormone assays cervical mucus evaluation, post-immunologic evaluation, endometrial biopsy, coital test hysterosalpingogram, laparoscopy, hysteroscopy, and Hamster-egg penetration assay.

Treatment of Female Infertility: The treatment of infertility can be done with surgery, medicine, assisted reproductive technology, artificial insemination. Many times these treatments are combined. Mostly infertility is treated with surgery or drugs. Specific treatments for infertility are recommended by doctors based on results of test, how long for the pregnancy the couple is trying, both the man and woman age, the partners overall health, and partners preference (30).

We are committed to the ethics of scientific research

Conflict of Interest: Nil

Source of Funding: Self

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Comparative Evaluation of Knowledge and Awareness about Diabetes Complication on Oral Health among Diabetic and Non-Diabetic Population

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ABSTRACT

Diabetic patients awareness and attitudes toward their heightened risk for oral diseases is very much essential to overcome the same. Hence the present study was conducted to explore the knowledge and awareness.

Methodology: A close ended questionnaire study was done to assess the knowledge, attitude & practice regarding oral health among 150 diabetic & non diabetic study subjects.

Results: There was statistically significant difference was noted among diabetic in many areas of knowledge, attitude & practice related to oral health.

Conclusion: Though knowledge was comparatively good among diabetic subjects, there were lacunae in attitude & practice. Hence continuous educational programs are recommended.

Keywords: Diabetic, Non-diabetic, Oral health problems, Attitude, Knowledge.

Introduction

The prevalence of diabetes mellitus (DM) is rising many factors are responsible for this increase like unhealthy Western lifestyles with reduced physical activity, sedentary lifestyles, this contribute to obesity which is a risk factor for the development of diabetes.¹ Due to a lack of proper awareness and education, diabetes sufferers are particularly prone to complications and increased mortality.²

Diabetes mellitus comprises a group of metabolic disorder characterized by hyperglycemia secondary to defects in insulin secretions, insulin action or both. Type 1 diabetes is characterized by decreased secretion of insulin due to autoimmune or idiopathic destruction of the B cells in the pancreas while type 2 diabetes, the more common form, is characterized by insulin resistance in peripheral tissues generally in combination with decreased insulin secretion.³ Type 1 and Type 2 diabetes have a genetic predisposition.⁴ The etiology of type 2 diabetes also appear to be related to the consumption of a high-fat, high-sugar diet, physical inactivity, and obesity.⁵

Diabetic patient who do not cautiously control their blood glucose levels will be at greater risk for systemic and oral complications. The chronic manifestation of DM are classified as macrovascular and microvascular complications.⁶

Diabetic patient display a higher prevalence of oral disorder such as xerostomia, taste impairment, sialosis, oral candidiasis, and oral lichen planus.⁷ Studies indicated that diabetic patient are two to three times more likely to develop periodontal disease⁸ and display

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a greater severity of periodontal disease.\cite{9} The severity of which is related to the long-term metabolic control of diabetes, not the duration of diabetes.\cite{9}

Knowledge about susceptibility to periodontal diseases, dry mouth and prevention of oral complications as well as effective management of conditions for people with diabetes is therefore important. Research has demonstrated that improving oral health knowledge is a necessary prerequisite for implementation of proper oral self-care behaviors,\cite{10} although knowledge of correct behaviors does not necessarily translate to practice.\cite{11}

Lack of essential oral health knowledge may increase the risks of diabetic oral complications.\cite{12} Despite the worldwide recognition of the dangers of diabetes mellitus, diabetic patients awareness of and attitudes toward their heightened risk for oral diseases has not been fully addressed. Hence, the present study was conducted to explore the knowledge and awareness of diabetes complications on oral health among diabetics and non-diabetics population in Alkharj, KSA.

**Aim and Objectives**

1. To assess the knowledge about diabetes complication on oral health among diabetic and non-diabetic.

2. To assess the awareness about diabetes complication on oral health among diabetic and non-diabetic.

**Materials and Method**

This study was conducted after obtaining permission from King Khalid Hospital Al-kharj. Informed consent was taken from each subject during answering the questionnaire. People denying giving consent were excluded. The present study was a cross sectional study. It was conducted among 20 - 50 years old people. A close ended questionnaire was designed. Questions were explained whenever necessary and the participants were given assurance regarding the confidentiality of their responses and were requested to mark their answers and complete it individually.

Convenience sample of 75 diabetic and 75 non diabetic subjects was taken. The sample was taken from the pool of patients attending Prince Sattam bin Abdul Aziz University Dental College, Alkharj and King Khalid Hospital Alkharj. Diabetic patients, with type 1 or type 2 diabetes mellitus, and non-diabetic individuals willing to participate were included in the study. Patients with diagnosis of diabetes mellitus for which they were receiving treatment are confirmed through electronic glucometer (Beurer blood glucose monitor GL42 and Beurer blood glucose test strips GL44) with random blood sugar level more than 120 mg/dl. Non-diabetic subjects were selected by asking the subjects about diabetes history and confirmation through electronic glucometer (Beurer blood glucose monitor GL42 and Beurer blood glucose test strips GL44) if RBS was around 80-120 mg/dl.

The examiner who was conducting RBS test using electronic glucometer was calibrated in the Prince Sattam bin Abdul Aziz University Dental College, Alkharj.

The questionnaire was distributed among the selected subjects. The questionnaire consists of questions related to age, sex, type and duration of diabetes, and their knowledge regarding systemic and oral complications associated with diabetes. Also, the questionnaire includes questions to assess participants attitudes toward maintaining good oral health.

**Results**

A total 150 study subjects were participated in the study. Of these 75 (50%) were diabetic & 75 (50%) were non diabetic. The age ranged between 20–60 years.

**Table 1: Age wise distribution of study subjects**

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Diabetics (n = 75)</th>
<th>Non diabetic (n = 75)</th>
<th>Total (n = 150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30 years</td>
<td>20 (26.66)</td>
<td>6 (8.00)</td>
<td>26</td>
</tr>
<tr>
<td>31-40 years</td>
<td>24 (32.00)</td>
<td>14 (18.66)</td>
<td>38</td>
</tr>
<tr>
<td>41-50 years</td>
<td>26 (34.66)</td>
<td>51 (68.00)</td>
<td>77</td>
</tr>
<tr>
<td>&gt; 50 years</td>
<td>05 (6.66)</td>
<td>4 (5.33)</td>
<td>09</td>
</tr>
</tbody>
</table>

Table 1 shows the age group distribution among diabetic & non diabetic group where more percentage of study subjects were seen in 41-50 years.
Table 2: Gender wise distribution of study subjects

<table>
<thead>
<tr>
<th>Gender</th>
<th>Diabetics (n = 75)</th>
<th>Non diabetic (n = 75)</th>
<th>Total (n = 150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>60 (80.00)</td>
<td>58 (77.33)</td>
<td>118</td>
</tr>
<tr>
<td>Female</td>
<td>15 (20.00)</td>
<td>17 (22.67)</td>
<td>32</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 0.502; p \text{ value} = 0.285 \]

Table 2 shows gender wise distribution of study subjects. In both diabetic & non diabetic groups, males were more common than females.

Questions Related to Awareness of Diabetes among Study Subjects: 96% of study subjects who were diabetic were aware of diabetes whereas among non diabetics only 52% of subjects were aware. Diabetic status of study subjects revealed that 73.33% of diabetics were aware of their diabetes status where as 21.33% were unaware. Among non diabetics 13.34% of study subjects were unaware about their diabetes status. The result was statistically significant. Regarding the awareness about Type of diabetes among study subjects, 14.66% of diabetics were unaware about the type. 24% of subjects were unaware about the duration since when they were suffering from diabetes. 32% reported that they were suffering from 5 – 10 years and 2.66% were suffering from > 10 years. Regarding knowledge about complication on general health among study subjects, knowledge was more among diabetics (96%) than compared to non diabetics (73.33%) which were statistically significant. Knowledge about complication on oral health among study subjects showed knowledge was almost similar among diabetics (73.33%) & non diabetics (66.66%) which was statistically non significant. Knowledge of complications associated with diabetes among study subjects was more among diabetics (32%) than compared to non-diabetic (24%) which was statistically significant. Comparatively more non diabetics (22.66%) were unaware of complications than diabetics (8%).

Questions Related to Practices in Dentistry: Regular visit to dentist among study subjects was more among diabetics (60%) than compared to non diabetics (48%). This result was statistically significant. Last dental visit among study subjects showed 32% diabetics had last visit within 6 months compared to non diabetics (24%) which was statistically significant. Dry mouth experience among study subjects was more among diabetics (74.66%) than compared to non diabetics (45.33%) & it was statistically significant. Bad breath experience among study subjects was more among diabetics (52%) than compared to non diabetics (40%). The result was statistically significant. Knowledge about Diabetes cause gum disease among study subjects which was similar among diabetics (57.33%) to non diabetics (60%) which was statistically non significant. Gum problems suffering by study subjects showed that only 9.34% of diabetics were free from gum disease than compared to 40% of non diabetics. Result was statistically significant.

Questions Related to Attitude of the Study Subjects about Oral Health: The brushing habits were similar among both the groups with majority of study subjects brushing once daily. Attitude of study subjects towards oral hygiene importance showed positive attitude was more among both the groups & the result was statistically non significant. Related to regular dental visit among study subjects was slightly more among diabetic group (88%) than compared to non diabetic group (74.66%). Result was statistically significant.

Discussion

In the present study the age ranged between 20-60 years and majority of the respondents were within the age group of 41-50 (34.66%). This may be attributed to the fact that most of the diabetic patients are usually diagnosed at this age. At this age patients are more eager to take care of their health and so visit the diabetic clinic often. And in this study males were more in number than females. Regarding diabetic awareness those subjects who are known diabetic (96%) were aware of diabetes whereas among non diabetics only 52% of study subjects were aware of diabetes. One important finding of the study is 21.33% who are diabetic are unaware about their diabetes status as diabetes requires some consideration of signs and symptoms to get diagnosed. In the present study 14.66% of diabetics were unaware about the type & 24.00 % of subjects are unaware about the duration. The present study tells that knowledge about complication on general health among diabetics was more because, once the person is diagnosed as diabetics he/she will try to understand more about the disease.
The consideration given to oral health is least so there was no difference about oral health among diabetics and non-diabetics. Periodontitis is a major complication in diabetes. Knowledge on oral health relation to diabetes was assessed to find out if the respondents had this information and if it reflected on their attitude and practice towards oral health. Most of the respondents considered oral health as a complication of diabetes (58%) but expressed that they don’t receive any information on oral health when they attend the diabetic clinic (45.7%) thus they don’t pay much emphasis as other complications associated with diabetes. This lack of information to the diabetic patients and need for it could be compared to a study done in Finland. On the knowledge related to complications associated with diabetes, knowledge was more among diabetics (32.00%) than compared to non-diabetics (24%) due to the facts of suffering and self-experience. Majority of patients had their last visit to the dentist more than 5 years back (25.3%) and others had never been to a dentist (22.8%). This is in contrary to a study done in Finland in which 63% of participants had attended a dental appointment within the last year. In this study the most frequent (61.5%) reason for a dental visit was some sort of pain or trouble with teeth or gums. In a study done in Finland the most frequent reason for a dental visit was a normal checkup (47%). The difference in the results can be attributed to the fact that yearly dental check-ups are not emphasis in Kenya. Being a developing country, oral health care is not affordable to most of the people. In this study, it was noted that the patients felt that their teeth were very important to them (92.9%) and that cleaning of teeth was important to them (83.3%) and for those with bad breathe (61.9%) it bothered them (71%) but still there practices on cleaning of their teeth did not reflect only a few of them cleaned their teeth twice or more a day (38.3%). This is in comparison in a recent study among Finnish adults with diabetes. Twice-a-day brushing was reported by 50% of those surveyed. It is thought that though the respondents at Kenyatta National Hospital diabetic clinic had knowledge on oral health and that their teeth are important to them, most of them come from poor socio-economic status and thus getting basic needs is a problem and this made getting dental care they can afford almost impossible. Among the respondents (67.95%) thought that changing their oral hygiene practices would improve their oral health but the problem was how to go about it because they had other complications that they felt needed more urgent attention. Majority also had the knowledge that they were at higher risk of developing oral diseases (59.5%) and that oral disease were preventable (67.90%). Most of the respondents used a toothbrush (85.7%) and tooth paste to clean their teeth but teeth and gums problems were still major issues. In comparison to a study done in Nigeria habits of tooth cleaning either with toothbrush and paste or with chewing stick was entrenched in the participants. The teeth and gum problems may be attributed to the tooth brushing techniques. The patients may be brushing daily but with minimal plaque elimination due to poor tooth brushing techniques.

Conclusion

1. Majority of the diabetic patients had knowledge on oral hygiene practices. They were aware of the causes of oral diseases and how they can be prevented. They also knew that there was a relationship between developments of oral diseases due to diabetes and that they were at a higher risk of developing oral diseases.

2. Their attitude was good still not very enthusiastic. They wanted to have better oral hygiene but did not do much about it. Practice was the major setback for these patients to achieve good oral health.

3. Most of the patients did not carry out good oral hygiene practices and only visited the dentist when they were in a lot of pain and discomfort. They hardly went for yearly dental check-ups.

Limitations: The sample size achieved was 150 due to time factor.

Recommendations

1. Continuous Educational Programs should be put in place especially in diabetic clinics to further enlighten diabetic patients on association of oral health with diabetes.

2. A similar study should be carried out with a larger sample group to attain a generalized picture on the knowledge, attitude and practices among diabetic patients on oral health.

3. A study as to why these diabetic patients don’t practice good oral hygiene should be conducted

Ethical Clearance: Taken from Institutional Review Board of college of dentistry, Prince Sattam Bin Abdulaziz University.
**Source of Funding:** Self

**Conflict of Interest:** Nil

**REFERENCES**


Hypertension and Maternal Preterm Delivery in Budi Kemuliaan Mother and Child Hospital Jakarta

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ABSTRACT

Newborn deaths are a major obstacle to further reducing child mortality especially in development country including Indonesia. Most of the causes of newborn deaths can be overcome. Preterm birth is the main cause (60-80%) of neonatal morbidity and mortality worldwide. Preterm labor occurs in pregnancy less than 37 weeks (between 20-37 weeks) with a fetal weight of less than 2500 grams. The aim of this study was to identify the association of maternal hypertension and preterm delivery of women in Budi Kemuliaan Mother and Child Hospital Jakarta, 2017.

Research conducted with cross sectional approach with 505 as a subjects used in this research. Woman with or more than 140 mm/hg of systolic blood pressure categorized are suffering from hypertension and less than 140 mm/hg categorized as normotensif.

Research showed that about 34.1% of subjects categorized as hypertension and 24.6% of total subjects in preterm delivery. Multivariate analysis using logistic regression showed that statistically there is no association between maternal hypertension with preterm delivery in Budi Kemuliaan Mother and Child Hospital, Jakarta, Indonesia, 2017.

Based on this study there was no significant relationship between hypertension of pregnant women with preterm events. Socialization of prevention of complications at the time of pregnancy is highly recommended to prevent the occurrence of preterm delivery and other complications that can arise.

Keywords: Maternal hypertension, Preterm Delivery

Introduction

Infant mortality rate (IMR) is one indicator of assessing public health status. Most child deaths in Indonesia currently occur in the newborn (neonatal) mostly in very first month of life. The possibility of children dying at different ages is 19 per thousand during the neonatal period, 15 per thousand from ages 2 to 11 months and 10 per thousand from ages one to five years. As in other developing countries that achieve middle income status, child mortality in Indonesia due to infection and illness of other children has decreased, along with increased maternal education, household hygiene and the environment, income and access to health services. Newborn mortality is now a major obstacle in reducing further child mortality. Most of the causes of newborn deaths can be overcome. (1)

In Indonesia, according to the 2015 annual report reported that the biggest causes of neonatal deaths were LBW by 37%, then asphyxia (26%), followed by others (21%), congenital abnormalities (12%), sepsis (4%) and Tetanus Neonatorium which is close to 0% (MOH, 2015). Neonatal death is often associated with prematurity, asphyxia and infection (2).

An estimated 15 million babies are born too early every year. That is more than 1 in 10 babies. Approximately 1 million children die each year due to complications of preterm birth (3). Many survivors face a
lifetime of disability, including learning disabilities and visual and hearing problems. Globally, prematurity is the leading cause of death in children under the age of 5 years. And in almost all countries with reliable data, preterm birth rates are increasing. \(^{(4)}\)

Inequalities in survival rates around the world are stark. In low-income settings, half of the babies born at or below 32 weeks (2 months early) die due to a lack of feasible, cost-effective care, such as warmth, breastfeeding support, and basic care for infections and breathing difficulties. In high-income countries, almost all of these babies survive. Suboptimal use of technology in middle-income settings is causing an increased burden of disability among preterm babies who survive the neonatal period \(^{(4)}\).

Preterm birth is a major cause (60-80%) of neonatal morbidity and mortality worldwide. Preterm delivery occurs during pregnancy less than 37 weeks (between 20-37 weeks) with fetal weight less than 2500 grams. In developing countries the incidence of preterm delivery is much higher, namely in India 30%, South Africa 15%, Sudan 31% and Malaysia 10%. The incidence of preterm birth in Indonesia is around 19% and is a major cause of perinatal death \(^{(5)}\).

WHO (2012) reported that the incidence of preterm births in Indonesia in 2010 was 15.5 per 100 live births and placed Indonesia in the 9th highest position out of 184 countries. This figure is quite large when compared to the country of Belarus which ranks last with the number of preterm births of 4.1 per 100 live births. Meanwhile, compared to other ASEAN countries, Indonesia has the highest incidence of preterm births, followed by the Philippines (14.9 per 100 live births), and Myanmar (12.4 per 100 live births). \(^{(6)}\)

According to The American Congress of Obstetricians and Gynecologists (COG) and the Center for Disease Control and Prevention (CDC) preterm labor is defined as birth at a gestational age between 20 weeks to less than 37 weeks. \(^{(7-10)}\) Various problems can be caused by premature birth. Premature babies have a higher risk of death compared to babies born at term. This is because they have difficulty adapting to life outside the womb due to immaturity of their organ systems. Other problems that can arise from premature birth are neurological development problems that vary from severe neurological disorders, such as blindness, impaired vision, and deafness. Premature birth can also lead to milder disorders such as behavioral abnormalities, learning difficulties and language, concentration/attention disorders and hyperactivity. This can result in the low quality of human resources in the future. In addition, the treatment of premature babies also requires sophisticated and expensive medical technology \(^{(11)}\).

Preterm birth occurs for a variety of reasons. Most preterm births happen spontaneously, but some are due to early induction of labour or caesarean birth, whether for medical or non-medical reasons. Common causes of preterm birth include multiple pregnancies, infections and chronic conditions such as diabetes and high blood pressure; however, often no cause is identified. There could also be a genetic influence. \(^{(4)}\)

The purpose of this study was to analyze the relationship of hypertension in pregnant women with preterm delivery in Budi Kemuliaan Mother and Child Hospital Jakarta after being controlled by age covariate variables, maternal education, maternal working status, maternal hemoglobin levels and birth spacing.

**Method**

The study was conducted with a cross sectional design, using medical record data from RSIA Budi Kemerdekaan Jakarta in 2017. Minimum sample size of 432 and inclusion criteria were inpatients who gave birth in RSIA Budi Kemuliaan in 2017, having complete medical records in accordance with variables needed and giving birth to single or non-twin babies both alive and dead. While the exclusion criteria are mothers who give birth with medical records not found or incomplete, mothers who have severe infections (malaria, syphilis, tuberculosis, HIV) and babies born more than a month (> 42 weeks) and gemelli. Mother with or more than 140 mm/Hg systolic blood pressure is categorized hypertension in this research.

The variables in this study were hypertension in pregnancy (independent variables), preterm delivery (dependent variable) and as a confounding variable, mother education, mother working status, distance of infant birth and maternal hemoglobin levels in 3rd trimester.

The dataset is then processed and analyzed. Univariate analysis is done to see the frequency distribution of each variable from the results of the study. Bivariate analysis was carried out on two allegedly related variables, namely husband’s participation and delivery service. The statistical test used is the chi-square test. Multivariate analysis was also conducted to control the effect of confounding factors, using logistic regression test.
Result

Analysis Multivariat Logistic Regression: In this study a multivariate regression logistic analysis was used to examine the relationship between maternal hypertension and preterm delivery and over after controlled with mother education, mother working status, parity and delivery space. From table 1 above shows that of the total number of subjects most of the patients were 333 respondents (65.9%) had hypertension and 75.4% of the subjects were preterm delivery. Most of the mothers were highly educated (79.2%) and chose to be a housewife than work (66.5%). And for other maternal risk factors, the majority of the study sample had risky parity that is <1 or ≥4 (83.2%) and the distance of birth <2 years or > 5 years (76.6%) with Hb status that most of them had high (75.6%)

From the results of the analysis of table 2 shows that the variables above do not show a significant association with the incidence of preterm delivery where all CIs of all variables pass the number 1 and statistically p value does not show a significant relationship (p> 0.05) and table 3 shows an analysis of the relationship of hypertension with preterm delivery after being controlled by other variables as shown in the following table.

### Table 1: Subject Characteristics of Budi Kemuliaan Mother and Child Hospital (n = 505)

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>172</td>
<td>34.1</td>
</tr>
<tr>
<td>No</td>
<td>333</td>
<td>65.9</td>
</tr>
<tr>
<td>Preterm Delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>121</td>
<td>24.6</td>
</tr>
<tr>
<td>No</td>
<td>381</td>
<td>75.4</td>
</tr>
<tr>
<td>Mother Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less Educated</td>
<td>105</td>
<td>20.8</td>
</tr>
<tr>
<td>High Educated</td>
<td>400</td>
<td>79.2</td>
</tr>
<tr>
<td>Mother Working Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working</td>
<td>169</td>
<td>33.5</td>
</tr>
<tr>
<td>Housewife</td>
<td>336</td>
<td>66.5</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1 or ≥4</td>
<td>420</td>
<td>83.2</td>
</tr>
<tr>
<td>2-3</td>
<td>85</td>
<td>16.8</td>
</tr>
<tr>
<td>Delivery Space</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2 years or &gt;5 yrs</td>
<td>387</td>
<td>76.6</td>
</tr>
<tr>
<td>2-5 years</td>
<td>118</td>
<td>23.4</td>
</tr>
<tr>
<td>Hb Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>123</td>
<td>24.4</td>
</tr>
<tr>
<td>High</td>
<td>382</td>
<td>75.6</td>
</tr>
</tbody>
</table>

### Table 2: Unadjusted Association of Independent Variable with Preterm Delivery of Budi Kemuliaan Mother and Child Hospital (n = 505)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unadjusted RR (CI 95%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>0.86 (0.55-1.32)</td>
<td>0.48</td>
</tr>
<tr>
<td>Mother Working Status</td>
<td>0.93 (0.6-1.43)</td>
<td>0.74</td>
</tr>
<tr>
<td>Mother Education</td>
<td>1.31 (0.8-2.11)</td>
<td>0.28</td>
</tr>
<tr>
<td>Parity</td>
<td>0.92 (0.54-1.57)</td>
<td>0.76</td>
</tr>
<tr>
<td>Delivery Space</td>
<td>0.94 (0.59-1.51)</td>
<td>0.76</td>
</tr>
<tr>
<td>Hb Status</td>
<td>1.12 (0.7-1.77)</td>
<td>0.67</td>
</tr>
</tbody>
</table>

### Table 3: Result from Stepwise Logistic Regression Model of Independent and Covariate Factor with Preterm Delivery

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full Model</th>
<th>Reduced Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted RR (CI 95%)</td>
<td>P Value</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Yes</td>
<td>1.239 (0.51-3.03)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1</td>
</tr>
</tbody>
</table>
Conted…

<table>
<thead>
<tr>
<th>Mother Working Status</th>
<th>Working</th>
<th>1,02 (0,64-1,62)</th>
<th>0,94</th>
<th>1,1 (0,71-1,7)</th>
<th>0,68</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housewife</td>
<td>1</td>
<td>Ref.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Mother Education      | Less Educated | 0,79 (0,35-1,79) | 0,58 | - | - |
|                       | High Educated | 1               | Ref. | - | - |

| Parity                | <1 or ≥4   | 1,12 (0,65-1,92) | 0,69 | - | - |
|                       | 2-3       | 1               | Ref. | - | - |

| Delivery Space        | <2 yrs or >5 yrs | 1,06 (0,63-1,67) | 0,92 | - | - |
|                       | 2-5 yrs     | 1               | Ref. | - | - |

| Hb Status             | Low       | 0,91 (0,57-1,45) | 0,68 | - | - |
|                       | High      | 1               | Ref  | - | - |

**Discussion**

Based on the results of bivariate analysis in this study showed that the probability of the occurrence of preterm delivery in mothers who experience hypertension during pregnancy showed RR 1.169 (95% CI 0.758-1.803), which means that hypertension in pregnancy has a risk of 1,169 times to experience preterm delivery, but when viewed from the confidence interval that passed the number 1 that there was no statistically significant relationship between hypertension and preterm delivery.

After controlling the covariate variables in multivariate analysis, showing the final model of hypertension relationship in pregnancy with the incidence of preterm delivery in RSIA Budi Kemuliaan showed an RR value of 1,123 (95% CI 0,711-1,774) which means that it did not show the same significant relationship as the results of bivariate analysis.

There is no correlation between hypertension and the incidence of preterm delivery in RSIA Budi Kemerdakaan Jakarta because preterm delivery is a health problem caused by many factors where factors that are very influential include the nutritional factors of pregnant women and maternal factors during pregnancy itself.

This research is not in line with previous studies where in general research concerning the relationship of hypertension in pregnant women with the same preterm incidence in 2010. Hypertension is one of the factors affecting the mother during pregnancy which is a risk factor for preterm delivery. Blood pressure in the first trimester of pregnancy tends to be the same as blood pressure before becoming pregnant. In the second trimester, blood pressure tends to decrease a few millimeters of mercury (mmHg). Blood pressure increases again in the third trimester, so that at this time high blood pressure is often found even before preeclampsia occurs. Changes in blood pressure also occur in women who have hypertension before pregnancy so that blood pressure in the second trimester is the lowest (12).

In this study also maternal hypertension status was not yet known whether the mother was in the category of hypertension in pregnancy, chronic hypertension or preeclampsia and eclampsia, so it could be that the number of mothers who were not hypertensive because the mother had been given treatment in the form of medicines from the hospital at the first times diagnosed and monitored pregnancy in the hospital so that there would be no effect that would result from hypertension at later delivery. The importance of other variables to be measured and examined also causes this research to be able to get different results.

**Conclusion**

Based on the results of the analysis showed that there was no significant relationship between hypertension of pregnant women with preterm events. In addition to preterm delivery, many other effects will arise from hypertension in childbirth so that the socialization of prevention of complications at the time of pregnancy is highly recommended to prevent the occurrence of preterm delivery and other complications that can arise.

**Acknowledgements**

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Ethical Clearance: Taken from Ethics Commission for Research and Community Health Services, Faculty of Public Health, Universitas Indonesia.

Conflicts of Interest: We have no conflict of interest to declare.

REFERENCES


Effects of *Trichuris* Muris Infection on Mice (*Mus musculus*)

Intestine

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¹Department of Parasitology, ²Student, ³Department of Anatomy, Faculty of Medicine, Lambung Mangkurat University, Indonesia

**ABSTRACT**

Helminth infection can influence immunopathology in human body. Changes in the length of intestine and release an increased goblet cell is one of the defense mechanisms against worm infections. In this study, we analyze effects of *Trichuris* muris infection towards goblet cells number and the length of villi and crypt intestine of mice. This research was a true experimental with the posttest control group design. The subjects were 30 males mice types BALB/c which 2 months old with an average weight 20-30 grams. Samples were taken by simple random sampling. Mice divided into a control group, low-dose group and high-dose groups. All subject was observed for 30 days, and the intestine was taken for measured length of villi and crypt. Counting of goblet cells used preparation of intestine. Data analysis used one way Anova and continued by post hoc test. The result show that crypt and villi on large and small intestine will be longer in mice with *Trichuris muris* infection. The average value of the goblet cells number in the control group, low-dose and high dose increased by higher dose worm eggs and had the value (p <= 0.05). *Trichuris muris* infection has influenced the length of villi and crypt intestine and the number of goblet cells in mice (*Mus musculus*).

**Keywords:** *Trichuris muris*, length of intestinum, goblet cells number

**Introduction**

Worm infection is still a neglected health problem in Indonesia because it is chronic and silent clinical symptoms. *Trichuris trichiura* is believed to infect about 800 million people worldwide, with the majority being children. Infected children show signs of malnutrition, stunted growth, intellectual retardation and educational deficits. *Trichurus muris*, a mouse model of *T.trichiura* infection in humans, have greatly contributed to improve knowledge on components of immune responses and how the immune systems induces parasite expulsion.¹

The contraction of the smooth muscle that lines the gastrointestinal tract is one possible mechanism that aids expulsion of the *T.muris* parasite.² It has been demonstrated that the immune system can, in fact, mediate muscle contraction. Investigations into muscle hypercontractility in *T. muris* infection have also revealed an increase with infection.³ Therefore, muscle hypercontractility may be an important effector mechanism for expelling *T. muris*.

Chronic intestinal nematode infections cause altered gut architecture, suggested that increased turnover of epithelial cells in the gut may prevent the parasite from remaining embedded within the host. Specifically, *T. muris* infection is associated with enhanced epithelial stem cell proliferation within the crypts of Lieberkühn in the large intestine, which is mediated by IFN-γ, and results in a massive crypt hyperplasia.⁴

The mucus layer forms the first barrier between the lumen and the small bowel epithelium, with mucin secretion. Changes in goblet cell proliferation and mucin mucus composition occurred in mice infected with *T. muris*. An increase in the amount of mucus makes Trichuris cyst more difficult in maintaining the acidity.⁵ This study characterized goblet cell count and length of villi and intestinal crypt in mice with *T.muris* infection.

**DOI Number:** 10.5958/0976-5506.2019.01048.9
Materials and Method

Mice: Male BALB/c mice with 2 month age and average weight 20–30 gram were obtained from Yogyakarta Veterinary Research and Investigation Center (BPPV). The animal studies were performed under the regulation Home Office Scientific Procedure Act (1986).

Parasite: T.muris was maintained as describe previously. Mice were infected by oral gavage to give either 200 embryonated eggs (high level) and 40 eggs (low dose) in double distilled H2O. Worm burden are assessed in 30 day post infection.

Tissue Preparation: Large and small intestine was taken as long as 2 cm distal from the cecum and flushed out by NaCl 0.9%, then put into 10% NBF for fixation. Tissue were prepare by using gut bundle technique. Tissue were then cut using microtome blades with a thickness of 0.3–0.5 μm and arranged into a tissue cassette, and stain with hematoxylin eosin (HE).

Measurement of Length of Villi and Crypt Intestine: Histologic preparations have been made visually observed using a microscope with weak magnification (10x10). Full length longitudinal and transversal section were selected to analysis at 9-10 mice per group. Individual villi and crypt length were determined by selecting well orientated villi and crypt, and measuring from the base to the lumen.

Determine the Number of Goblet Cell: Calculating the number of goblet cell by looking on HE stained section at 9-10 mice per group. Goblet cells taken on the villi and crypt, viewed 10 cells that are bounded clearly, easily visible and uninterrupted.

Statistical Analysis: Statistical analysis was performed by using one way analysis of varian (ANOVA) with post hoc. Analysis was performed by using SPSS program. p-values <0.05 were considered statistically significant.

Result and Discussion

A. The length of intestinal villi and crypta in Mice (Mus musculus) after infection with Trichuris muris.

Figure 1: The length of intestinal villi and crypt in mice after Trichuris muris infection (in μm).

Figure 1 shows the differences in crypt and villi lengths in intestinal crassum and intestinal tenue in the treatment group. Based on statistical analysis with one way anova show that crypt and villi on intestinum crissum and intestinum tenue will be longer in mice with Trichuris muris infection. The measurements of length of villi and intestinal crypt are shown in Figure 2 below.

Figure 2: The measurements of length of villi and crypt in intestinal mice (longitudinal section, stained with HE with magnification 10 x 10); A. Mice in control group; B. Mice given a low dose of Trichuris muris eggs, and C: Mice given ah high dose of Trichuris muris egg
B. The number of Goblet cell in intestinum mice (*Mus musculus*) after *Trichuris muris* infection

![Figure 3: The average number of Goblet Cells in intestinum mice after Trichuris muris infection.](image)

![Figure 4: Goblet cell in mice (*Mus musculus*) intestine after Trichuris muris infection with magnification 10 x 10, Transversal section, stained with HE (A: Intestinal mice in control groups, B: Intestinal mice in a low dose Trichuris muris infection, C: Intestinal mice in a high dose Trichuris muris infection)](image)

*Trichuris muris* will invade epithelial cells within 24 hours after ingestion by mice. The intestinal mucosa forms a defense against the external environment in the form of intrinsic defenses consisting of epithelial cell layers and extrinsic defenses which are combination of goblet cells that produce mucous. ¹

Immune mediated expulsion of intestinal dwelling nematodes can involve the interplay between CD4+ T cell and gut epithelium. The immune response to *T. muris* has been well characterized in terms of cytokine production in the draining lymph node, with a type 2 dominated response an absolute requirement for worm expulsion. ¹

The development of a Th2-type of response is associated with fast parasite expulsion whereas a Th1 response is linked to establishment of chronic infection and increased immunopathology. The use of BALB/c strain in this research has been crucial in determining important cellular and molecular pathways of importance during *T. muris* infection. In BALB/c mice, if they infected by high dose, immune response will develop Th2 type. ⁵

*T. muris* are capable of modulating immune response of their host to prevent expulsion. Indeed, it has been shown that development of inappropriate Th1 response leads to chronic infection. It associated with high levels of IFN-γ, IL-12 and IL-18 in susceptible mouse. Resistance is also associated with decreased production of the Th1-inducing cytokine IL-18. Resistance are usually produced against high dose *T. muris* infection and lead to parasite expulsion by triggering expulsion mechanism such as increased epithelial cell turnover, mucin production and muscle hypercontractility. Two cytokines that play a major role in the resistance to infection are IL-4 and IL-13. ⁵

Prolonged infection with gastrointestinal parasites can result in severe damage to surrounding tissues if not properly regulated. *T. muris* infection can cause
severe transmural inflammation in colon. Mucosal and submucosal inflammation result in destruction of normal crypt architecture during chronic infection.²

Chronic infection with T. muris has been associated with crypt hyperplasia accompanied by both increased epithelial cell proliferation and apoptosis. In this study a given low dose and high dose of T. Muris egg in 30 day, capable change the length of villi and crypt intestine of mice. These processes might be controlled by pro inflammatory cytokine IFN-γ and can also control the excessive extension of crypt in chronic infection. Resistant mice have accelerated epithelial cell turnover, a mechanism which is directly linked to faster parasite expulsion. These findings led to a model referred to as the ‘epithelial escalator’, where epithelial cells move from the bottom of the crypt (proliferation zone) to its top (shedding zone), moving the parasite embedded in the epithelial layer towards the lumen where the epithelium and parasite are shed. In this study, BALB/c mice were able to regulate epithelial turnover during infection. The difference in epithelial cell turnover between resistant and susceptible mice is due to differences in the immune response and their cytokine profile. Some studies have shown the role of IL-4 and IL-13 to the difference. On the other hand, IFN-γ and CXCL10 (IFN-γ-induced protein), both are associated with Th1 responses and susceptibility to T. Muris infections, responsible for down-regulatory epithelial cell transition.⁸

The second mechanism of expulsion parasite in gastrointestinal tract is mucin production by goblet cells. Goblet cells are major producers of mucins (the major protein component of mucus) and form an important element of the innate defence in the gastrointestinal tract.¹ Goblet cell hyperplasia is observed during T. muris infection in both resistance and susceptible animals. This study showed that the number of goblet cells in the gastrointestinal tract would increase in mice infected with high dose compared with low-dose infected or uninfected (p<0.05).

Goblet cells are protective mucus cells that are protective to lubricate the gastrointestinal tract. The more inflammation that occurs the more mucus is produced by goblet cells as a cell defense. Goblet cell secretions contain glycoproteins (80% carbohydrates and 20% protein) released by the exocytosis process. Increased goblet cells are under control of the Th2 cytokine although also an increase in IL-4 or IL-13 may also occur. 26 IL-4 and IL-13 is a regulation of the main source of improvement ITF (intestinal trefoil factor) that interacts with mucin to increase the viscosity of the mucous gel in goblet cells.⁷

In this study, there was an increase in the number of goblet cells in T. muris infected mice compared with uninfected mice. After infection with T.muris, an increase of the number IEC that serves for expulsion of the parasite. IgE production increases in cases of worm infections. This is due to the activation of mastocyte degranulation of ECF-A (Eosinofil Chemotactic Factor) which can encourage the collection of eosinophilic cells that potentially kill the worms in tissues. High dose infection (> 150 eggs) has a more dominant Th2 immune response whereas low-dose infection (<15 eggs) has a more dominant Th1 immune response.

As long as Trichuris infected the cysts occur hyperproliferation of cells in the intestine. It also shows that the mycotic trichuris persists in its host by eliciting a Th1 immune response and leads to enterocyte cell hyperplasia that occurs during chronic infection. While Th2 leads to an acute infection in the mechanism of expulsion of worms and resulted in goblet cell hyperplasia as activation of transcription factors involved in goblet cell differentiation.⁸

Acute infections, MUC4, Muc13 and Muc17 mucin cell surfaces when infected with Trichuris muris result in increased apical glyocalyx thickness along with increased glycoprotein synthesis in goblet cells involved in the process of expulsion of worms. The hypersecretion of glycoproteins is mediated by α3 (GABA-α3) gamma amino-butyric receptors under IL-13 control.⁴

Chronic infection leads to caecum morphological changes and no significant changes were observed in goblet cell numbers and an increase in epithelial cell count was associated with chronicity. During chronic infection, the barrier mucus decreases as the glycoprotein decreases resulting in commensal flora coming back into the epithelial cell lining, which can lead to exacerbation of epithelial inflammation. The role of macrophages during worm infections increases significantly as in the peritoneal cavity suggests that this occurs because the proliferation of IL-4 is more than the precursors in the blood.
Conclusions

1. The average length of the villi and the intestinal crypt increased with the infection of *Trichuris muris*, the more infected eggs, the longer the size of villi and crypt (p values <0.05).

2. The average value of the goblet cells number in the control group, low-dose and high dose increased by higher dose worm eggs and had the value (p values < 0.05).

3. *Trichuris muris* infection has influenced towards the length of villi and crypt and the goblet cells number in intestinum of mice (*Mus musculus*).

Ethical Clearance: This study approved and received ethical clearance from the Committee of Public Health Research Ethics of Medical Faculty, Lambung Mangkurat University, Indonesia. The informed consent included the research title, purpose, participants’s right, confidentiality and signature.

Source of Funding: This study done by Faculty of Medicine, Lambung Mangkurat University Funding

Conflict of Interest: The authors declare that they have no conflict interest.

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Association between Frequency of Internet Access and Knowledge of Danger Signs in Pregnancy among Women of Childbearing Age in Indonesia

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1Department of Surgical Oncology, Dharmais Hospital, Jakarta; 2Department of Epidemiology, Faculty of Public Health, University of Indonesia

ABSTRACT

The aim of this study was to determine the association of internet access frequency with knowledge of danger signs in pregnancy among women of childbearing age. Data obtained from the Indonesia Demographic Health Survey 2017, which interviewed and obtained complete data for 23,849 women of childbearing age, was analyzed using Cox regression with statistical significance defined by a 95% confidence interval. Sample prevalence of women of childbearing age who had a good knowledge of danger signs was 31.9%; respondents who access the internet every day made up 31.4% of the sample. Our sample was predominantly women 35–44 years old (29.1%), living in urban areas (55.7%), with a secondary education level (54.7%), and working (54.7%). A significant association was shown between internet access and the participants’ knowledge of danger signs in pregnancy, with an adjusted prevalence ratio of 1.27, 95% CI [1.20–1.35]. Internet access increased knowledge of danger signs in pregnancy in women of childbearing age.

Keywords: danger signs in pregnancy, women of childbearing age, Indonesia, Demographic Health Survey 2017 (DHS VII)

Introduction

Obstetric danger signs are an indication of something wrong with a pregnant woman during pregnancy, childbirth, or postpartum.1 Even though the danger sign itself may not be a major problem, a delay in seeking health services can occur if a woman can’t define it.2,3 This is certainly dangerous for the mother, her pregnancy, and the baby.

Maternal Mortality Ratio (MMR) is one of the focuses of Sustainable Development Goals (SDGs). Worldwide, the highest MMR is in sub-Saharan African countries (546 per 100,000); in 2015, Asia recorded an MMR of 110 per 100,000. Indonesia’s MMR has decreased from year to year, but the current estimate is still above the all-Asia MMR, at around 126 per 100,000. Various factors trigger maternal deaths such as bleeding, high fever, and seizures.4

Prevalence of knowledge about obstetric danger signs across countries differs: in rural Tanzania, 51.1% of mothers can identify at least one obstetric danger sign,5 while in Somali District, Ethiopia, 15.5% of respondents can identify a minimum of two obstetric danger signs6 and in Southern Ethiopia, that figure is 21.9%.7 Several other studies separate knowledge of obstetric danger signs based on processes during pregnancy, childbirth, and postpartum. In India, a study of 170 pregnant women with 25 danger signs of pregnancy found that 29.3% of the women had good knowledge of danger signs.8 In contrast, a study in Goba District, Ethiopia, found at least 68.1% of women of childbearing age could name at least three danger signs of pregnancy.9

Nowadays, internet access is something that cannot be separated from daily life. In Sweden, 91% of women can get access to the internet and around 84% seek
information related to pregnancy, especially in early pregnancy. Another study in Ireland found that 97% of pregnant women access the internet and 83% of pregnant women use information on the internet to help them decide on a course of action for their pregnancy-related problems. In Turkey, 45% of pregnant women use the internet to seek information related to pregnancy. High internet access, especially for pregnant women, can certainly increase pregnancy-related knowledge, especially concerning danger signs during pregnancy. The purpose of this study was to identify the role of internet access in boosting knowledge of the danger signs of pregnancy in women of childbearing age among the Indonesian population.

**Material and Method**

**Study Design and Sample:** A cross-sectional study was conducted by analyzing Indonesian Demographic Health Survey (DHS) 2017 data. The DHS was designed to provide an overview of fertility data, family planning, and maternal and child health in Indonesia. This survey used two stages of stratified sampling, selecting census blocks by probability proportional to size (PPS) and by 25 households per census block (total 49,250 households). There were 50,730 women aged 15–49 years who fit the eligibility criteria, but the respondents who were successfully interviewed totaled 49,627 women. A total of 23,859 women of childbearing age supplied a complete data profile and those were analyzed in this study.

**Operational Definition**

**Knowledge of Danger Signs in Pregnancy:** In this study, a woman of childbearing age is considered as knowledgeable about danger signs in pregnancy if she can spontaneously mention four danger signs that occur. The interviewer did not mention any of these signs to the respondent.

**Frequency of Internet Access:** The operational definition of internet access is determined by frequency of internet usage. Respondents were classified into four categories: those who access the internet almost every day, at least once a week, less than once a week, or never.

Data in the DHS 2017 was collected from July 24 to September 30, 2017 throughout Indonesia by 145 teams spread across selected regions. Each team consisted of eight people as follows: one supervisor, one editor for women of childbearing age and married men, four women interviewing women of childbearing age, one man interviewing married men (who concurrently acted as editor for teenage boys) and one man interviewing teenage boys.

This study used a questionnaire for women of childbearing age.

**Data Analysis**

SPSS version 20 was used to code and analyze the DHS 2017 data. The level of knowledge, frequency of internet access and other covariate variables were described by frequency and percentage. Bivariate analysis was conducted using Cox regression to determine the crude prevalence ratio (PR). All variables in bivariate analysis with p < 0.25 were a candidate for further analysis. A backward step was undertaken to eliminate the variables which didn’t meet the significance level. Multivariate analysis was seen to obtain adjusted PR. Significance level in this study was valued at a 95% confidence interval.

**Findings**

The analysis included 23,849 women of childbearing age whose data were complete. Respondents were considered knowledgeable about danger signs in pregnancy if they were able to mention a minimum of four danger signs spontaneously; on this criterion, the prevalence of good knowledge was 31.9%. The prevalence increased if we applied a lower standard: for three danger signs, the prevalence of good knowledge was 59%, for two signs the prevalence was 79.1%, and for one sign the prevalence was 93%.

The respondents were typically aged between 35 and 44 (29.1%), were educated to secondary level (54.7%), lived in an urban area (55.7%), and were in employment (58.8%). In terms of marital and family status, 93.1% of respondents were married, 66.9% had a maximum of two children, and 9.6% were not pregnant. Information was collected about media access through the internet, newspapers or magazines, and radio or television. Of
the respondents, 31.4% accessed the internet every day, 11.7% read newspapers/magazines at least once a week, 12.8% listened to radio at least once a week, and 85.4% watched television at least once a week (Table 1).

Bivariate analysis was carried out to obtain crude PR values. After all the covariate variables were analyzed, three variables had significance values >0.25, namely experience of termination of pregnancy, marital status, and employment status. The remaining covariate variables met the inclusion criteria for the multivariate model: age, number of children, place of residence, level of education, reading newspapers/magazines, listening to the radio, and watching television. The results of multivariate analysis between frequency of internet access and knowledge of danger signs in pregnancy can be seen in Tables 2 and 3.

Table 1: Characteristics of Respondents: Women Aged 15–49

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of danger signs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>16,234</td>
<td>68.1</td>
</tr>
<tr>
<td>Good</td>
<td>7,615</td>
<td>31.9</td>
</tr>
<tr>
<td>Internet access</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>13,757</td>
<td>57.7</td>
</tr>
<tr>
<td>Less than once a week</td>
<td>680</td>
<td>2.9</td>
</tr>
<tr>
<td>At least once a week</td>
<td>1,919</td>
<td>8.0</td>
</tr>
<tr>
<td>Almost every day</td>
<td>7,493</td>
<td>31.4</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–24 years old</td>
<td>2,402</td>
<td>10.1</td>
</tr>
<tr>
<td>25–34 years old</td>
<td>8,414</td>
<td>35.3</td>
</tr>
<tr>
<td>35–44 years old</td>
<td>9,322</td>
<td>39.1</td>
</tr>
<tr>
<td>&gt; 44 years old</td>
<td>3,711</td>
<td>15.6</td>
</tr>
<tr>
<td>Number of children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2 children</td>
<td>15,955</td>
<td>66.9</td>
</tr>
<tr>
<td>&gt; 2 children</td>
<td>7,894</td>
<td>33.1</td>
</tr>
<tr>
<td>Place of residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>10,569</td>
<td>44.3</td>
</tr>
<tr>
<td>Urban</td>
<td>13,280</td>
<td>55.7</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No school</td>
<td>280</td>
<td>1.2</td>
</tr>
<tr>
<td>Primary</td>
<td>6,136</td>
<td>25.7</td>
</tr>
<tr>
<td>Secondary</td>
<td>13,040</td>
<td>54.7</td>
</tr>
<tr>
<td>Higher</td>
<td>4,393</td>
<td>18.4</td>
</tr>
<tr>
<td>Pregnancy status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not pregnant</td>
<td>22,568</td>
<td>94.6</td>
</tr>
<tr>
<td>Pregnant</td>
<td>1,281</td>
<td>5.4</td>
</tr>
<tr>
<td>Termination of pregnancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>19,548</td>
<td>82.0</td>
</tr>
<tr>
<td>At least once</td>
<td>4,301</td>
<td>18.0</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not married</td>
<td>112</td>
<td>0.5</td>
</tr>
<tr>
<td>Married</td>
<td>22,200</td>
<td>93.1</td>
</tr>
<tr>
<td>Living with a partner</td>
<td>156</td>
<td>0.7</td>
</tr>
<tr>
<td>Widowed</td>
<td>513</td>
<td>2.2</td>
</tr>
<tr>
<td>Divorced</td>
<td>796</td>
<td>3.3</td>
</tr>
<tr>
<td>Not living with a partner</td>
<td>72</td>
<td>0.3</td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>9,815</td>
<td>41.2</td>
</tr>
<tr>
<td>Employed</td>
<td>14,034</td>
<td>58.8</td>
</tr>
<tr>
<td>Reads newspapers/magazines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>12,883</td>
<td>54.0</td>
</tr>
<tr>
<td>Less than once a week</td>
<td>8,176</td>
<td>34.3</td>
</tr>
<tr>
<td>At least once a week</td>
<td>2,790</td>
<td>11.7</td>
</tr>
</tbody>
</table>
Table 2: Multivariate Analysis of Frequency of Internet Access to Knowledge of Pregnancy Danger Sign: Analysis of 2017 IDHS Data (First Model)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prevalence Ratio</th>
<th>95.0% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than once a week</td>
<td>1.05</td>
<td>0.92–1.21</td>
<td>0.46</td>
</tr>
<tr>
<td>At least once a week</td>
<td>1.14</td>
<td>1.05–1.25</td>
<td>0.00</td>
</tr>
<tr>
<td>Every day</td>
<td>1.24</td>
<td>1.17–1.32</td>
<td>0.00</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–24 years old</td>
<td>1.12</td>
<td>1.01–1.25</td>
<td>0.03</td>
</tr>
<tr>
<td>25–34 years old</td>
<td>1.28</td>
<td>1.18–1.38</td>
<td>0.00</td>
</tr>
<tr>
<td>35–44 years old</td>
<td>1.14</td>
<td>1.06–1.23</td>
<td>0.00</td>
</tr>
<tr>
<td>Place of residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban vs Rural</td>
<td>1.03</td>
<td>0.98–1.08</td>
<td>0.26</td>
</tr>
<tr>
<td>Number of children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2 vs &gt; 2</td>
<td>0.89</td>
<td>0.85–0.94</td>
<td>0.00</td>
</tr>
<tr>
<td>Pregnancy status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnant vs Not pregnant</td>
<td>1.11</td>
<td>1.01–1.22</td>
<td>0.03</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>1.29</td>
<td>0.96–1.73</td>
<td>0.09</td>
</tr>
<tr>
<td>Secondary</td>
<td>1.66</td>
<td>1.24–2.23</td>
<td>0.00</td>
</tr>
<tr>
<td>Higher</td>
<td>2.01</td>
<td>1.49–2.71</td>
<td>0.00</td>
</tr>
<tr>
<td>Reads a newspaper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than once a week</td>
<td>1.02</td>
<td>0.96–1.07</td>
<td>0.58</td>
</tr>
<tr>
<td>At least once a week</td>
<td>1.05</td>
<td>0.97–1.14</td>
<td>0.22</td>
</tr>
<tr>
<td>Listens to the radio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than once a week</td>
<td>1.06</td>
<td>0.99–1.11</td>
<td>0.05</td>
</tr>
<tr>
<td>At least once a week</td>
<td>1.02</td>
<td>0.95–1.09</td>
<td>0.62</td>
</tr>
<tr>
<td>Watches television</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than once a week</td>
<td>1.10</td>
<td>0.93–1.29</td>
<td>0.25</td>
</tr>
<tr>
<td>At least once a week</td>
<td>1.13</td>
<td>0.97–1.31</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Table 3: Multivariate Analysis of Frequency of Internet Access to Knowledge of Pregnancy Danger Sign: Analysis of 2017 IDHS Data (Final Model)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prevalence Ratio</th>
<th>95.0% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than once a week</td>
<td>1.06</td>
<td>0.93–1.22</td>
<td>0.36</td>
</tr>
<tr>
<td>At least once a week</td>
<td>1.16</td>
<td>1.06–1.27</td>
<td>0.00</td>
</tr>
<tr>
<td>Every day</td>
<td>1.27</td>
<td>1.20–1.35</td>
<td>0.00</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–24 years old</td>
<td>1.11</td>
<td>1.00–1.23</td>
<td>0.00</td>
</tr>
<tr>
<td>25–34 years old</td>
<td>1.27</td>
<td>1.17–1.37</td>
<td>0.04</td>
</tr>
<tr>
<td>35–44 years old</td>
<td>1.14</td>
<td>1.05–1.22</td>
<td>0.00</td>
</tr>
<tr>
<td>Number of children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2 vs &gt; 2</td>
<td>0.89</td>
<td>0.85–0.94</td>
<td>0.00</td>
</tr>
<tr>
<td>Pregnancy status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnant vs Not pregnant</td>
<td>1.11</td>
<td>1.01–1.22</td>
<td>0.03</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>1.33</td>
<td>0.99–1.78</td>
<td>0.05</td>
</tr>
<tr>
<td>Secondary</td>
<td>1.73</td>
<td>1.30–2.33</td>
<td>0.00</td>
</tr>
<tr>
<td>Higher</td>
<td>2.13</td>
<td>1.58–2.87</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Compared to respondents who never accessed the internet, those who accessed the internet every day had an association of 1.27, 95% CI [1.20–1.35] with good knowledge of danger signs in pregnancy; the association decreased with the frequency of internet access. Compared to respondents who did not access the internet at all, those who accessed the internet at least once a week had an association of 1.16, 95% CI [1.06–1.7], while those who accessed the internet less than once a week had an association of 1.06, 95% CI [0.93–1.22].

**Discussion**

In this study, a woman was classified as have good knowledge if she was able to mention four danger signs in pregnancy; the prevalence of this was 31.9%. In a study conducted in Jordan, the prevalence of mentioning four danger signs was lower, at 15.1%. If the lower standard of mentioning three danger signs is applied in the present study, the prevalence of good knowledge is 59%, higher than the 46.74% reported for a study in Raya Kobo, Ethiopia. Labour, and postnatal period is the first essential step for appropriate and timely referral. This study aimed to investigate predictors of knowledge about obstetric danger signs during pregnancy, delivery, and postpartum period among mothers of reproductive age women who gave birth in the last 12 months. A quantitative community based cross-sectional study was employed during March 2016. The study included 493 mothers who were selected by multi-stage sampling technique. Data were collected by face-to-face interview. Logistic regression analyses were employed to identify factors associated with knowledge of obstetric danger signs. Variables with a p-value <0.05 were identified as statistically significant factors. About forty-seven percent (46.7%) If the standard is lowered further to two danger signs and one danger sign, the prevalence in the present study are 79% and 93%, respectively. A study in Uganda using the standard of one danger sign found that the proportion of well-informed respondents was 52%. During delivery and 72% during postpartum. Only 19% had knowledge of 3 or more key danger signs during the three periods. Of the four birth preparedness practices; 91% had saved money, 71% had bought birth materials, 61% identified a health professional and 61% identified means of transport. Overall 35% of the respondents were birth prepared. The relationship between knowledge of at least one key danger sign during pregnancy or during postpartum and birth preparedness showed statistical significance which persisted after adjusting for probable confounders (OR 1.8, 95% CI: 1.2-2.6) The data therefore show that the application of different standards will affect the prevalence of good knowledge: the lower the standard, the higher the prevalence of women who have good knowledge. Regardless of the standard applied, the prevalence of good knowledge of danger signs in pregnancy is higher in Indonesia than in other countries.

The internet is a source of information that is widely used, especially by pregnant women. In this study, the prevalence of accessing the internet every day was around 31.4%, once a week was 8%, and less than once a week was 2.9%. Studies in China and Sweden have given the prevalence of women accessing the internet as 91.9% and 91%, respectively; however, these two studies did not report frequency of internet access.

The aim of this study was to determine the association in women of childbearing age between frequency of internet access and knowledge of danger signs of pregnancy. The results show that the more frequent respondents’ access to the internet, the better their level of knowledge about danger signs in pregnancy. Compared to women of childbearing age who never accessed the internet, women who accessed the internet every day had an association of 1.27 with good knowledge of danger signs in pregnancy, women who accessed the internet once a week had an association of 1.16, and women who accessed the internet less than once a week had an association of only 1.06.

Studies of the association between frequency of internet access and level of knowledge of danger signs in pregnancy have so far been limited. Some research has focused on the relationship between internet access and general information about pregnancy. For example, a study conducted in Sweden found that 84% of pregnant women accessed the internet to find information about pregnancy, especially in the first trimester; 70% of respondents did not discuss their findings with health workers, and 55% had sought information on the internet because of the influence of health workers. In China, 75.1% of women obtained information about pregnancy from the internet, but not specific in searching for danger sign.

**Study Limitations:** The 2017 DHS data focus on the frequency with which women of childbearing age accessed the internet. In this study, therefore, it was not possible to provide detailed information about the types of content accessed through the internet by the respondents.
Conclusion

The prevalence among women of childbearing age of good knowledge of danger signs in pregnancy was 31.9%, and the prevalence of women accessing the internet on a daily basis was 31.4%. We conclude that there was an association between accessing the internet and knowledge of danger signs in pregnancy.

Conflict of Interest: Both authors declare that there is no competing interest in this paper.

Source of Funding: All funding was provided by the authors.

Ethical Clearance: All respondents agreed to be interviewed, and all data were anonymous. A letter of permission was obtained from the National Population and Family Planning Board (No. 141/LB.01/H3/2019).

Acknowledgment

The authors are grateful to the National Population and Family Planning Board (Badan Kependudukan dan Keluarga Berencana Nasional/BKKBN) for providing the data.

REFERENCES


14. Bililign N, Mulatu T. Knowledge of obstetric danger signs and associated factors among reproductive age women in Raya Kobo district


Assessment on Knowledge of Factors Influencing Uterine Prolapse and Its Prevention among Women in Selected Rural Communities of Shimla, Himachal Pradesh, India

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ABSTRACT

Objectives: Womanhood is the time in a girl’s life after she has progressed through early days in childhood and adolescence. Having reached womanhood, no woman feels complete without becoming a mother.

Method: In view of the nature of the problem under the study, and to achieve the objectives of the study, a descriptive approach and a non-experimental descriptive design were found to be appropriate to describe the study. The data was collected from 100 women who were residing in the selected rural area at Shimla using Non-probability purposive sampling technique.

Result: Sample distribution according to the demographic characteristic showed that the study sample consists of 100 women in the age group of 21-35 years. Item-wise analysis revealed that 64 percent of women knew that “uterus is a part of reproductive system;” 68 percent of the respondents were aware that “prolapse is common in heavy lifting workers due to increased strain on pelvic muscles;” 50 percent of the respondents were aware that “vaginal discharge in uterine prolapse is white;” 76 percent of respondents knew that “constipation which can cause prolapse can be prevented by consuming fibre-rich diet”.

Conclusion: It is vital for the women to understand the key factors about uterine prolapse, especially the risk factors and preventive measures. Nurses in all settings play an important role in educating the community about health-related behaviour, risk factors, early screening, as well as preventive measures.

Keywords: Uterine Prolapse; Knowledge; Factors Influencing

Introduction

According to World Health Organisation’s estimation reproductive health accounts for 33 percent of the total disease burden in women globally. Reproductive health problems are the leading cause of ill health that exists throughout the nation. Studies have shown that among the reproductive health problems faced by women, the most common problems are cystocele (56 percent), uterine prolapse (53.6 percent) and rectocele (40 percent). This reveals that uterine prolapse is the second commonest reproductive health condition faced by women. The global prevalence of uterine prolapse is estimated to be 11-20 percent in women under the age of 45. It is estimated that more than 6,00,000 women in Nepal are suffering from uterine prolapse, out of which 18,600 are in need of surgical repair. Uterine prolapse is the most widespread reproductive health condition and is the neglected health issue. It is a complex condition that is often kept secret because of the shame of affecting a sensitive part of the women’s body. Many women fear condemnation from their community and families and they continue to remain silent on this matter. Statistics reveals that 6,00,000 women are affected by the disease out of which 2,00,000 require immediate treatment. Prolapse is mainly caused by improper care during the antenatal, intranatal and postnatal periods.
Method

In view of the nature of the problem under study and to accomplish the objectives of the study descriptive approach was found to be appropriate to describe the knowledge of women on factors influencing uterine prolapse and its prevention.

In view of the nature of the problem under study and to accomplish the objectives, a non-experimental descriptive design was found to be appropriate to describe the knowledge of women on factors influencing uterine prolapse and its prevention.

The study was conducted in selected rural areas under Surathkal PHC. In the present study, the target population consists of women residing in a selected rural area at Shimla, and accessible population consists of women in the age group of 21-35 years residing in a selected rural area at Shimla. The sample for the study consists of 100 women who met the inclusion criteria and are residing in a selected rural area at Shimla. Purposive sampling technique is a strategy in which researcher’s knowledge of the population and its elements are used to select sample which are typical to the population.

This study received ethical approval from the Institutional Review Board of the parent institution. Individual Informed consent was taken from the sample before the data collection.

Results

Part I: Description of demographic characteristics of women

Table 1: Percentage distribution of women according to their age (N = 100)

<table>
<thead>
<tr>
<th>Age of women</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-25 years</td>
<td>70</td>
<td>70.0</td>
</tr>
<tr>
<td>26-30 years</td>
<td>23</td>
<td>23.0</td>
</tr>
<tr>
<td>31-35 years</td>
<td>7</td>
<td>7.0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100.0</td>
</tr>
</tbody>
</table>

As per Table 1 percentage distribution of women according to their age shows that the highest percentage (70 percent) of the samples belonged to the age group of 21-25 years, 23 percent belonged to the age group of 26-30 years, and seven percent belonged to the age group of 31-35 years.

Part II: Analysis of knowledge of women regarding uterine prolapse and its prevention

Table 2: Level of Knowledge of women regarding uterine prolapse and its prevention (N = 100)

<table>
<thead>
<tr>
<th>Percentage of range of score</th>
<th>Level of knowledge</th>
<th>No. of respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40</td>
<td>Poor</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>41-60</td>
<td>Average</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>61-80</td>
<td>Good</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>81-100</td>
<td>very good</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

As per Table 2 in order to find out the level of knowledge of women, a four-point scale was used. The percentage scores were arbitrarily graded as follows: less than 40 percent – poor knowledge; 41-60 percent – average knowledge; 61-80 percent – good knowledge; and 81-100 percent – very good/excellent knowledge. Assessment of the level of knowledge of women showed that the highest percentage (75 percent) of the women had average knowledge and 25 percent had poor knowledge regarding uterine prolapse and its prevention.

Section B: Area-wise analysis of knowledge scores

Table 3: Area-wise mean, SD and mean percentage of knowledge scores of women regarding uterine prolapse and its prevention (N = 100)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Knowledge Areas</th>
<th>Max. possible score</th>
<th>Mean score</th>
<th>SD</th>
<th>Mean %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Structure and function of uterus</td>
<td>6</td>
<td>2.17</td>
<td>1.295</td>
<td>36.17</td>
</tr>
<tr>
<td>2</td>
<td>Factors influencing uterine prolapse</td>
<td>9</td>
<td>4.20</td>
<td>1.608</td>
<td>46.67</td>
</tr>
<tr>
<td>3</td>
<td>Signs and symptoms, diagnosis</td>
<td>5</td>
<td>2.07</td>
<td>1.075</td>
<td>41.40</td>
</tr>
<tr>
<td>4</td>
<td>Prevention of uterine prolapse</td>
<td>10</td>
<td>5.65</td>
<td>1.395</td>
<td>56.50</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>30</td>
<td>14.09</td>
<td>2.400</td>
<td>46.97</td>
</tr>
</tbody>
</table>
Table 3 shows that women had highest knowledge in the area of ‘prevention’ (56.50 percent) which had a mean and SD of 5.65 ± 1.395, whereas the mean percentage in the area of ‘factors influencing uterine prolapse’ was 46.67 percent with a mean and SD of 4.20 ± 1.608. This reveals that the knowledge of women regarding uterine prolapse was average.

Section C: Item-wise distribution of correct responses of women

Table 4: Item-wise distribution of correct responses of women regarding knowledge on factors influencing uterine prolapse (N = 100)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Item</th>
<th>Correct responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Uterine prolapse is more common in multiparous.</td>
<td>40 40</td>
</tr>
<tr>
<td>2.</td>
<td>Uterine prolapse can be caused by birth weight of baby more than 3.6 kilogram</td>
<td>34 34</td>
</tr>
<tr>
<td>3.</td>
<td>Major cause of uterine prolapse is fibroid uterus.</td>
<td>56 56</td>
</tr>
<tr>
<td>4.</td>
<td>Risk factor for uterine prolapse is smoking.</td>
<td>44 44</td>
</tr>
<tr>
<td>5.</td>
<td>Uterine prolapse is more prone in obese person.</td>
<td>42 42</td>
</tr>
<tr>
<td>6.</td>
<td>Condition predisposing to uterine prolapse is asthma.</td>
<td>35 35</td>
</tr>
<tr>
<td>7.</td>
<td>Pelvic surgery can contribute to uterine prolapse by damaging nerves in pelvis</td>
<td>63 63</td>
</tr>
<tr>
<td>8.</td>
<td>Prolapse is common in heavy lifting workers due to increased strain on pelvic muscles</td>
<td>68 68</td>
</tr>
<tr>
<td>9.</td>
<td>The precipitating factor for uterine prolapse is inadequate nutrition</td>
<td>46 46</td>
</tr>
</tbody>
</table>

As per Table 4, analysis reveals that 40 percent of the women knew that “Uterine prolapse is more common in multiparous;” 34 percent of the women knew that “Uterine prolapse can be caused by birth weight of baby more than 3.6 kilogram;” 56 percent of the women knew that “Major cause of uterine prolapse is fibroid uterus;” 44 percent of the respondents were aware that “Risk factor for uterine prolapse is smoking;” 42 percent of the respondents were aware that “Uterine prolapse is more prone in obese person.

Part III: Association between knowledge of the respondents on uterine prolapse and its prevention with demographic variables

To test the association between the knowledge of the subjects and selected demographic variables, the following hypothesis was formulated:

H₁: There is a significant association between knowledge score of the women on uterine prolapse, with the demographic variables such as age, religion, occupation, parity, education, monthly income and mode of delivery at 0.05 level of significance. The hypothesis was tested using chi-square test ($\chi^2$).

**Association between knowledge of the respondents on uterine prolapse and demographic variables**

Table 5: Association between knowledge of uterine prolapse with age (N = 100)

<table>
<thead>
<tr>
<th>Demographic variable</th>
<th>Knowledge score</th>
<th>Calculated value ($\chi^2$)</th>
<th>Table value</th>
<th>df</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of the mother</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>&lt; median (&lt; 14)</td>
<td>28</td>
<td>0.000</td>
<td>1</td>
<td>P = 1.000 NS</td>
</tr>
<tr>
<td></td>
<td>≥ median (≥ 14)</td>
<td>42</td>
<td>3.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NS: Not significant

As per Table 5, the calculated $\chi^2$ value is 0.000. The degree of freedom is one and the P value is 1.000. As the calculated value is less than that of the table value null hypothesis is accepted. So there is no significant association between knowledge of uterine prolapse with age of the women.
Table 6: Association between knowledge of uterine prolapse with parity (N = 100)

<table>
<thead>
<tr>
<th>Demographic variable</th>
<th>Knowledge score</th>
<th>Calculated value ($\chi^2$)</th>
<th>Table value</th>
<th>df</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; median (&lt; 14)</td>
<td>$\geq$ median ($\geq$ 14)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Para 1</td>
<td>19</td>
<td>22</td>
<td>2.932</td>
<td>2</td>
<td>P = 0.231 NS</td>
</tr>
<tr>
<td>Para 2</td>
<td>10</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Para 3 and above</td>
<td>11</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NS: Not significant

As per Table 6, the calculated $\chi^2$ value is 2.932. The degree of freedom is two and the P value is 0.231. As the calculated value is less than that of the table value null hypothesis is accepted. So there is no significant association between knowledge of uterine prolapse with parity.

Discussion

Part I: Percentage distribution of sample with reference to demographic variables: All the subjects belonged to the age group of 21-35 years. Seventy percent of the sample was aged 21-25 years; 41 percent of respondents were under parity one; 63 percent of the respondents belonged to Hindu religion; 70 percent of the respondents had primary education; 96 percent were housewives; 58 percent had income between Rs. 3001-4000; and 92 percent had undergone vaginal delivery.

A similar study was conducted in Nepal which revealed that 70 percent of women were in the age group of 20-40 years. Majority of the study population was illiterate (80 percent), Dalits (44 percent) and 50 percent belonged to low socioeconomic groups.

Part II: Knowledge of women regarding uterine prolapse and its prevention: Objective I: Determine the pre-existing knowledge of women on uterine prolapse and its prevention as measured by close ended structured interview schedule

Assessment of the level of knowledge of women showed that highest percentage (75 percent) of the sample had average knowledge and 25 percent of the women had poor knowledge regarding uterine prolapse. Analysis showed that women had highest knowledge in the area of ‘prevention’ (56.50 percent) which had a mean and SD of 5.65 ± 1.395, whereas the mean percentage in the area of ‘factors influencing uterine prolapse’ was 46.67 percent with a mean and SD of 4.20 ± 1.608. Similar findings were also reported in a study conducted in Alexandria among 291 women which revealed that more than two-thirds of the women (70.4 percent) had poor knowledge regarding uterine prolapse, 36.4 percent had fair knowledge and 29.6 percent had satisfactory knowledge regarding uterine prolapse.

Part III: Association of knowledge with demographic variables: Objective II: Find the association between knowledge scores and selected demographic variables such as age, parity, religion, education, occupation, monthly income and mode of delivery.

Chi-square was computed in order to find the association between knowledge and selected variables. The result revealed that there was no significant association between the knowledge of women and demographic variables such as age, parity, religion, education, occupation, monthly income and mode of delivery.

Similar findings have been reported in a study conducted at Alexandria. The results revealed that there was significant association between prolapse with parity (p=0.0001), unskilled birth attendant (p=0.0006), prolonged labour (p=0.007), early resumption of routine activities during puerperium (p=0.002), low socioeconomic group (p=0.001), and family history (p=0.001). Health education on distinctive perspectives of reproduction is exceedingly required to energize ladies to know and report their sufferings. Improving the skills of birth attendants, focussing on domiciliary obstetrics is also emphasised.

Conclusion

The study revealed that women had average knowledge on uterine prolapse and its prevention. There is a necessity to give health education to women to improve their knowledge on uterine prolapse and its prevention.
Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from the college of nursing ethical committee.

REFERENCES


Body Shape Index, Body Mass Index and Their Relation to Blood Pressure

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ABSTRACT

Aim: Body mass index was used as an indicator of body fat content. However, it fails to indicate the body fat in muscular individuals. Studies have shown the relationship between body mass index and blood pressure. Body shape index is a new anthropometric measurement introduced. We have evaluated the relationship of body shape index and body mass index with blood pressure.

Method: The cross-sectional descriptive study consists of 300 individuals between age 18 – 60 years. Height, weight and blood pressure were measured. body mass index and body shape index were calculated. Data analyzed by statistical tests to draw the inference.

Results: In our study body mass index was significantly increased with increasing age, unlike body shape index. A correlation was found between body mass index and body shape index. Systolic blood pressure was significantly correlated with body mass index as well as body shape index. However, diastolic blood pressure was correlated only with body mass index but not with body shape index.

Conclusion: We conclude that body mass index is better correlated with blood pressure than body shape index. It shows that body mass index is a better indicator of blood pressure than body shape index.

Keywords: Body Mass Index, Body shape index, Blood Pressure.

Introduction

WHO has defined obesity as body mass index (BMI) equal to or more than 30, measured using height and weight of an individual1. Though it is an indicator of the body fat mass, BMI has been criticized for its inefficiency to reflect the body fat distribution as it may not distinguish between fat mass and muscle mass2,3,4,5. BMI measures body fat but fails to reflect the abdominal fat distribution6. Data are available indicating regional distribution of fat is responsible for the comorbidities associated with the obesity7,8. Moreover, in young healthy adults BMI provide poor measure of fat mass but reflects skeletal muscle mass9. To overcome this short fall in the BMI, recently a new index was developed by Krakauer and Krakauer10 called A body shape index (ABSI), and observed the positive correlation with the abdominal fat deposition. It was also observed that ABSI is a better indicator than WC and BMI to predict mortality8. However other studies have indicated that it is a poor indicator of cardiovascular risk prediction9. Obesity statistics from the Malaysian National Health and Morbidity Survey in 2006 showed that 43% of Malaysian adults were obese or overweight11.

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million deaths every year\textsuperscript{12}. In Malaysia, one in every three adult Malaysians are hypertensive, or around 6.3 million individuals\textsuperscript{13} and the projected prevalence of hypertension in 2020 is estimated to be about 7.6 million Malaysians aged 18 years and above. BMI is related to BP but there is still much needed to be studied in developing countries Asia and Africa\textsuperscript{14}. We conducted this cross-sectional study to evaluate the relationship of ABSI, blood pressure and compare with BMI.

**Material and Method**

**Study Population:** A cross-sectional descriptive study was conducted on 300 individuals aged 18 to 60 years who were willing to participate in this study they apparently not on any type of medication or special diet and had not started any planned physical training. The sample size was calculated using the formula for single population. The random sampling method was used to collect the data. Those individuals who refused to participate, or who had begun physical training recently pregnant women, physically disabled individuals and individuals with endocrine disease such as hypothyroidism, infectious disease like tuberculosis and malignancies that might change the individual’s body size were excluded.

**Study Tools:** Data was collected using structured questionnaires consisting of 2 sections. Section A consisting of baseline characteristics and section B for anthropometric measurements. Weight was measured to the nearest 0.1 kg using electronic weighing scale (model 770: seca, Germany) with the respondents lightly clothed while the height was measured using the measuring tape with respondents (without shoes) standing still by applying the direct observation method. The BMI was calculated by using the formula BMI= Weight (kg)/ height (m)$^2$. Based on the BMI, cut off points for Asians is underweight (BMI < 18.5kg/m$^2$), normal (18.5-22.9 kg/m$^2$), overweight (23-27.49 kg/m$^2$) and obese (>27.5kg/m$^2$)\textsuperscript{15}. Body shape index was calculated by the formula ABSI = WC/[(BMI)$^{0.43}$ × height (m)$^{0.5}$]. Blood pressure was measured by sphygmomanometer. The left arm BP was measured after the individual had rested for 5 min. The average of two readings for each was used for analysis.

**Research Ethics:** Ethical approval for this study was obtained through the institutional research and ethics committee. The informed written consent was taken from all the participants.

**Statistical Methods:** The data of the study was analyzed using descriptive and inferential statistics. Results of the continuous measurements are presented as Mean ± SD and results on categorical measurements are presented in percentage. Significance is assessed at 5 % level of significance. To find the significance of study parameters between three or more groups, analysis of variance (ANOVA) and to find the degree of relationship between study variables Pearson correlation was performed.

**Statistical software:** The Statistical software used to analyze the data were SPSS 18.0, and R environment ver.3.2.2.

**Results**

In the present study consisting of 300 individuals, 150 were males and 150 were females. By considering BMI we observed that majority of the individuals of the study group were in the overweight category and nearly equal number were normal and obese (Table 1). Almost all individuals in the study group (95%) were with the ABSI between 0.08 to 1.0 and 5% were <0.08 (table 2) however no one was with ABSI >1. There was a statistically significant increase in BP and BMI between different age groups. However, we observed no significant increase in the BSI between different age groups (Table 3). Comparison of BP and ABSI of individuals under different groups categorized according to the BMI cut-off points for Asians had shown a statistically significant increase in the BP, and ABSI, between the groups (Table 4). In the study group there was a statistically highly significant correlation between the age of the individuals, BP (systolic and diastolic) with BMI (Table 5). However, ABSI had shown statistically strong correlation with BMI and systolic BP. The correlation between ABSI and diastolic BP was negative with no statistical significance (Table 5)

| Table 1: BMI (Asian population) distribution in the population studied |
|------------------|-----------------|---|
| BMI (kg/m$^2$)   | No. of Individuals | % |
| <18.5            | 22              | 7.3 |
| 18.5-22.9        | 58              | 19.3 |
| 23-27.5          | 168             | 56.0 |
| 27.5 & Above     | 52              | 17.3 |
| Total            | 300             | 100.0 |
Table 2: ABSI distribution in the population studied

<table>
<thead>
<tr>
<th>ABSI</th>
<th>No. of individuals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.08</td>
<td>15</td>
<td>5.0</td>
</tr>
<tr>
<td>0.08-0.1</td>
<td>285</td>
<td>95.0</td>
</tr>
<tr>
<td>&gt;0.1</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 3: Comparison of Clinical variables according to age in years

<table>
<thead>
<tr>
<th>Variables</th>
<th>18-20</th>
<th>21-30</th>
<th>31-40</th>
<th>41-50</th>
<th>51-60</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (mm Hg)</td>
<td>113.19±10.7</td>
<td>119.07±12.49</td>
<td>123.33±8.72</td>
<td>122.71±11.18</td>
<td>132.57±6.90</td>
<td>123.32±11.38</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>DBP (mm Hg)</td>
<td>71.63±9.10</td>
<td>77.86±10.20</td>
<td>79.59±6.51</td>
<td>82.96±7.63</td>
<td>81.55±3.68</td>
<td>79.98±8.06</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>ABSI</td>
<td>0.08±0.01</td>
<td>0.08±0.01</td>
<td>0.08±0.01</td>
<td>0.08±0.01</td>
<td>0.08±0.00</td>
<td>0.08±0.00</td>
<td>0.113</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>21.77±5.97</td>
<td>23.58±5.30</td>
<td>24.79±4.45</td>
<td>25.31±2.52</td>
<td>25.48±1.82</td>
<td>24.60±4.10</td>
<td>0.002**</td>
</tr>
</tbody>
</table>

* Moderately significant (p value: 0.01<P ≤ 0.05)** Strongly significant (p value: P≤0.01)

Table 4: Comparison of the BP according to BMI

<table>
<thead>
<tr>
<th>Variables</th>
<th>&lt; 18.5</th>
<th>18.5-22.9</th>
<th>23-27.5</th>
<th>≥ 27.5</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (mm Hg)</td>
<td>113.45±9.99</td>
<td>114.12±8.52</td>
<td>125.51±10.05</td>
<td>130.67±9.84</td>
<td>123.32±11.38</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>DBP (mm Hg)</td>
<td>72.23±9.02</td>
<td>75.47±7.29</td>
<td>80.78±5.62</td>
<td>85.69±10.03</td>
<td>79.98±8.06</td>
<td>&lt;0.001**</td>
</tr>
</tbody>
</table>

* Moderately significant (p value: 0.01<P ≤ 0.05)** Strongly significant (p value: P≤0.01)

Table 5: Correlation between BMI with Age, BSI and BP

<table>
<thead>
<tr>
<th>r value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m²) vs Age in years</td>
<td>0.237</td>
</tr>
<tr>
<td>BMI (kg/m²) vs SBP (mm Hg)</td>
<td>0.474</td>
</tr>
<tr>
<td>BMI (kg/m²) vs DBP (mm Hg)</td>
<td>0.418</td>
</tr>
<tr>
<td>ABSI vs Systolic SBP (mm Hg)</td>
<td>0.199</td>
</tr>
<tr>
<td>ABSI vs DBP (mm Hg)</td>
<td>-0.088</td>
</tr>
<tr>
<td>ABSI vs BMI (kg/m²)</td>
<td>0.278</td>
</tr>
</tbody>
</table>

* Moderately significant (p value: 0.01<P ≤ 0.05)** Strongly significant (p value: P≤0.01)

Discussion

The present cross-sectional study was conducted to evaluate the effect of ABSI and BMI, on BP and to assess which among them has better correlation. We also evaluated the BSI, BMI, among different age groups. We found strongly significant increase in BMI with increase in age but it was not true for ABSI. The overall average BMI of the population was 24.60 ± 4.10 kg/m² and this value almost coincided with the observations made by Azmi et al. They observed an overall BMI of 24.37 kg/m² and Azuwani et al. found the mean BMI 25.7±4.61 kg/m² among individuals in Malaysia. Furthermore, upon increasing age from 30 to 60 years, the population became over weight, when compared to a normal BMI in the age group of 18 to 29 year. The systolic and diastolic blood pressure also increased in these age groups. However, the BSI was constant in different age groups. Mungrepthy et al. found that the mean systolic and diastolic BP was higher among subjects who have higher BMI and older age. Nasarudin & Ahmad concluded that high BMI is very much a risk factor for hypertension.

We observed statistically highly significant increase in blood pressure in individuals as their BMI increased. We also observed statistically highly significant correlation between BMI and blood pressure (systolic & diastolic). However, the ABSI value remains the same even though the BMI changes. The correlation between the ABSI and Systolic blood pressure was highly...
significant but not the diastolic blood pressure. Jeong, & Lee 20 in their study observed negative relation between ABSI and diastolic blood pressure. In contrast to our study Duncan et al. 21 found out that ABSI and BMI were all significantly related to both SBP, DBP and ABSI and BMI were significant predictors of systolic blood pressure. The correlation between BMI and ABSI was highly significant. In a study conducted by Giudici & Martini 22 stated that the ABSI of adolescents correlated positively with the BMI which agrees with our findings. We conclude that an increase in BMI is associated with an increase in blood pressure. Even though the correlation between BMI and ABSI are significant, BMI is significantly correlated with both systolic and diastolic blood pressure whereas ABSI is significantly correlated only with systolic blood pressure. Hence, according to the results of our study, BMI is a better related to blood pressure than ABSI. However, a larger population needs to be studied.

Acknowledgement

We acknowledge the contribution of participants who willingly agreed to participate. We place on record the sincere thanks to International Medical School, Management and Science university for their support.

Conflict of Interest: Nil

Source of Funding: Self.

Ethical Clearance: Obtained from the institutional ethical and research committee.

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12. Osamor PE, Owumi BE. Factors associated with treatment compliance in hypertension in


Histomorphological and Histochemical Study of the Healthy Liver and Pancreas of Local Adult Homing Pigeon (*Columba Livia Domestica*)

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ABSTRACT

The purpose of this study was to describe, some the grossly and histological structures and histochemical features of the liver and pancreas of local adult homing pigeon. The present study was conducted on 20 local adult homing pigeon divided into two groups (10 for morphological study and 10 for histological and histochemical study). The morphological results showed that the liver located in the right and left hepatoperitoneal cavity, it has red- brown to dark brown in color, the weight of the liver was (1.59 ± 0.21%) in relation with the body weight. The liver is divided into two undivided lobes left and right, the right lobe is larger than left lobe, mean length, weight and thickness of wall of left and right lobes were (32.1 ± 0.41mm), (22.6 ± 0.23 gm), and (3.5 ± 0.02 mm); (43.7 ± 0.25 mm), (46.6 ± 0.16 gm), (4.2 ± 0.03 mm) respectively. the pancreas was long gland, is on the lower right side of the abdominal wall between the arms of the duodenum. The mean length and weight of pancreas was (97.5 ± 2.20 mm), (3.12 ± 0.26 gm) respectively. Histological examination revealed that the liver consist of several lobules separated from each other by thin trabeculae of connective tissue extend from delicate capsule that enclosed the liver. The basic unit of the parenchyma of liver is hepatocyte which arranged in plates or cords like that radiated around the central vein and between these cords there is sinusoids lined by a layer of fenestrated endothelial cells and Kupffer’s cells. In the boundary of each lobule showed portal area which consist of hepatic artery; hepatic vein and bile duct lined by cuboidal cells. The mean thickness of capsule, diameter of central vein, portal vein, hepatic artery and hepatic duct were (145 ± 12.6, 624 ± 32.4, 523 ± 90.0, 190 ± 20.4 and 325 ± 12.1 µm) respectively. The pancreas was serous tubuloacinar gland which covered by a thin connective tissue capsule consisted of collagenous, elastic and reticular fibers. The mean it thickness was (47 ± 2.2) µm. The parenchyma was consisted of exocrine portion and pancreatic islands. The pancreatic islands were composed of large Alpha and small Beta islets. The duct system composed of intercalated duct, intralobular duct, interlobular duct and main excretory duct. The histochemical study the hepatic cells were positive to periodic acid Schiff stain. The pancreatic islands were composed of large Alpha and small Beta islets.

Keywords: Homing pigeon, liver, pancreas, Histochemical, Histological.

Introduction

Birds have a single body chamber and do not have separation of the abdomen and thorax as in mammals¹. In avian species, the liver is a bilobed organ that lies in the mid-coelomic cavity of the body, ventrally and posteriorly to heart associated with proventriculus and spleen²,³,⁴. In most avian species, the left lobe is slightly smaller than the right lobe. The liver is largest gland of body, it is dark brown or red brown in color and the liver is both endocrine and exocrine gland releasing several substances directly into blood stream and secreting bile into duct system⁵. Embryologically, it derived from endoderm (hepatocyte and biliary epithelium) and mesoderm (stroma cells, satellite cells, kupffer’s cells and blood vessels⁶,⁷. Histologically, the

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liver of avian similar to that in mammals but there is some differences such as absent connective tissue septa between lobules except in portal area, duck liver consist of several lobules separated from each other by thin trabeculae of connective tissue extend from delicate capsule that enclosed the liver. in turkey, the hepatocytes are usually arranged as two cell thickness between the liver sinusoids. The portal area contained branch of portal vein, branch of hepatic artery and 2-3 inter lobar bile ducts. The liver is most important organ in the body. It has numerous functions, including digestive functions, metabolism of proteins, fats, and carbohydrates, detoxification, synthesizing and secreting bile. The avian pancreas is located on the right side of the abdominal cavity in all birds, the pancreas of the birds is considered to have four lobes: ventral, dorsal, third and splenic; with three ducts: ventral, dorsal and third, as described in chicken and quail. is consist of an endocrine portion or pancreatic islands and an exocrine portion. The pancreatic islands are responsible for the control of blood sugar concentration and consisted of isolated groups of pale staining islet cells called islets of Langerhans. The exocrine portion releases many essential electrolytes and digestive enzymes.

Materials and Method

For morpholgical study taken Ten adult health local birds (5 male and 5 female) were collected from local market in Muthana city during March 2019, the birds were killed after anesthesia by intramuscular injection of a mixture of ketamin and diazepam at dose 25 and 5 mg/kg of body weight. The body cavity was opened through a midventral incision, the liver and pancreas were immediately dissected out, measurement the mean length, weights and thickness of pancreas and measurement the mean length, weights and thickness of the left lobe and right lobe of liver by digital electronic verinia, measurement tape and ruler.

For histological and histochemical study the present study was carried out on specimens of liver and pancreas of adult health local birds, 5 specimens from different regions of each lobe of the liver were taken and fixed by 10% formalin 24 hours at room temperature, and then treated by routine histological processing embedding with paraffin wax (58-60 C) and sectioning to 5-7µm. The stains were used, Harries Hematoxylin and Eosin (H&E) for demonstrating the general histological components, Periodic Acid Schiff (PAS) for distinguish of carbohydrates, and Van Gesion stains for connective tissues. The slides were then dipped in xylene and mounted with cover slip using DPX mounting medium. The slides were examined under light microscope to study the general histology and histochemistry features of liver and pancreas. The mean thickness of capsule, diameter of hepatocytes, central vein, portal vein, hepatic artery and hepatic duct, The mean and the standard error were calculated for 5 slides for each lobe of liver and 5 slides of pancreas.

Result

The liver in present study proved that it was large and bilobed organ, lied in the right and left hepatoperitoneal cavity (Fig.1) and it has red-brown to dark brown in color, the weight of the liver was (1.59 ± 0.21%) in relation with the body weight and consisted of left and right lobes which were joined cranially at the midline by an interlobar portion. There was no gall bladder The left lobe has concavity in its top where the heart stabilized and it’s not divided into secondary lobes (Fig.1), and mean length, weights and thickness of wall of left lobe of liver were (32.1 ± 0.41) mm, (22.6 ± 0.23) gm., (3.5 ± 0.02) mm (Table 1), while the right lobe has concavity from its ventral side where the gizzard was stabilized, and it didn’t contain the incision that divided it into secondary lobes (Fig.1), mean length, weights and thickness of wall of right lobe were (43.7 ± 0.25) mm, (46.6 ± 0.16)gm., (4.2 ± 0.03) mm (Table 1), the pancreas was long gland, is on the lower right side of the abdominal wall between the arms of the duodenum (Fig.1), The mean length and weight of pancreas was (97.5 ± 2.20) mm, (3.12 ± 0.26) gm respectively.

The histological examination of this study revealed that the liver composed of a parenchyma covered by capsule which is composed of regular dense connective tissue that contains collagen, reticular and elastic fibers. This capsule also contains lymphatic vessels, collagen fibers and fibroblasts (Fig. 2,3). The parenchyma of the liver consists of hepatocytes which are arranged in plates, its thickness was either one cell or two cells around sinusoids. The hepatocytes constitute parallel cords to the capsule whereas it was arranged radially inward composing small lobules and acini, hepatocytes radiated around the central vein and between these cords there is sinusoids lined by a layer of fenestrated endothelial cells. Lumen of sinusoids contained mainly erythrocytes and macrophages. In the boundary of each lobule showed portal area which consist of hepatic artery; hepatic vein and bile duct lining by cuboidal cells (Fig.3). The mean thickness of capsule, diameter
of central vein, portal vein, hepatic artery and hepatic duct in each left and right lobes of liver were (145 ± 12.6) µm, (624 ± 32.4) µm, (523 ± 90.0) µm, (190 ± 20.4) µm and (325 ± 12.1) µm respectively (Table 1). The pancreas was serous tubuloacinar gland which covered by a thin connective tissue capsule consisted of collagenous, elastic and reticular fibers (Fig.4). The gland’s parenchyma was consisted of exocrine portion and pancreatic islands The mean thickness of pancreas capsule in this study was (47 ± 2.2) µm. The duct system composed of intercalated duct, intralobular duct, interlobular duct and main excretory duct (Fig.4).

Histochemically, The hepatic cells were positive to periodic acid schiff stain (Fig.3).The pancreatic islands were composed of large Alpha and small Beta islets, The epithelial cells take the red color by Van Gieson stain (Fig.4). The acinar cells of the pancreas contains red granules with PAS - AB (Fig. 4).

Table 1: Measurement of thickness of capsule, diameter of central vein, portal vein, hepatic artery and hepatic duct of the liver and pancreas of homing pigeon (µm) (X ± S.E).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Part</th>
<th>Left lobe of liver</th>
<th>Right lobe of liver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness of capsule</td>
<td>145 ± 12.6</td>
<td>145 ± 12.6</td>
<td></td>
</tr>
<tr>
<td>Diameter of central vein</td>
<td>624 ± 32.4</td>
<td>624 ± 32.4</td>
<td></td>
</tr>
<tr>
<td>Diameter of portal vein</td>
<td>523 ± 90.0</td>
<td>523 ± 90.0</td>
<td></td>
</tr>
<tr>
<td>Diameter of hepatic artery</td>
<td>190 ± 20.4</td>
<td>190 ± 20.4</td>
<td></td>
</tr>
<tr>
<td>Diameter of hepatic duct</td>
<td>325 ± 12.1</td>
<td>325 ± 12.1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1: Macroscopic section of liver and pancreas in pigeon, showing : no gall bladder, (A). liver, (B). duodenum, (C). gizzard, (D). pancreas, no gall bladder

Fig. 2: Gross microscopic section of liver in pigeon BD. Bile duct, HA. Hepatic artery, CV. Central vein, H. hepatocyte, S. blood sinusoid, H & E stain (X400).

Fig. 3: Gross microscopic section from liver in pigeon : BD. bile duct, CV. Central vein, H. hepatocyte, S. blood sinusoid, HA. Hepatic artery PAS stain (X400).

Fig. 4: Gross section from pancreas in pigeon : CT. connective tissue, EP. Exocrine, EN.endocrine, Md. Main duct, FB.Fibroblast, L. islets of Langerhans, Van Gesion stain (X400).
Discussion

The liver of pigeon located in the right and left hepatoperitoneal cavity, it has red-brown to dark brown color. This result agreed with\(^1\), who said that the normal color of the adult male geese was red-brown to dark brown and disagree with\(^2\) who remained that the normal color of the avian liver depends on the nutritional state of the bird and it is red-brown or it may be light brown but it is yellow if the bird is on a high-fat diet. A gross examination of the present study showed that the liver was a bilobed, these results are accompanied with the description of others birds such as captive bustards\(^3\), ostrich\(^4\) **Odonus niger**\(^5\), **Struthio camelus**\(^6\) and other avian\(^7\). The size, weight and color of the liver are dependent on the breed, age and nutritional status of the individual bird\(^8\). The pancreas was long gland, is on the lower right side of the abdominal wall between the arms of the duodenum, This finding is in agreement with the result\(^9\).

The parenchyma of the liver lobule is composed of hepatocyte arranged in branching plates and this separated by blood sinusoids and arranged in radiation the result was similar to these observed in turkey and pintail duck in\(^2\) numerous granules of glycogen in the cytoplasm, this agree with\(^1\) in chicken. The pancreas gland is cover with a thin capsule which concords with the findings\(^1\) in geese. In contrast, the capsule of pancreas was thick in the turkeys\(^1\). The capsule of pancreas was made up of collagenous, elastic and reticular fibers, which correlate to the findings of\(^2\) in duck and\(^1\) in geese. Stated that the features of the mucous of the epithelium of the pancreatic duct are found to be different depending on the type of digestion\(^1\). The duct system of pigeon pancreas composed of intercalated duct, intralobular duct, interlobular duct and main excretory duct. This finding is in agreement with the results\(^7\). the hepatic cells were positive to periodic acid schiff and alcian blue reactions, The pancreatic islands were composed of large Alpha and small Beta islets, these similar to\(^1\) in chicken. These pancreatic islets which consisted of various shapes of large Alpha and small Beta islets were in agreement with the previous findings\(^15\).

Conflict of Interest: This research is a personal non-profit work and there is no conflict of interest.

Source of Funding: None.

Ethical Clearance: Ethical clearance was obtained from the Faculty Scientific Committee (Department of Anatomy College of Veterinary Medicine/AL Muthanna University/Iraq,) to study the histomorphological and histochemical of the healthy liver and pancreas of local Adult homing pigeon (Columba livia domestica).

References

11.


The Ameliorative Effects of Chrysin against Methandienone-Induced Change in Blood Parameters in Mice

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ABSTRACT

Objective: investigate the effects of methandienone on blood cells and compared to those of normal and chrysin supplementation conditions

Materials and Method: Male Mus musculus mice (8-12 weeks in age, 25.00 ± 2.00 gm weight) were acquired, seven experimental groups, each with 5 mice. The negative control group was treated with distilled water. The positive control group was treated with 20mg/kg of cyclophosphamide (CFA) twice a week for two weeks. Methandienone-treated group received the drug (1mg/kg body weight) orally on a daily volume of 0.1 ml for one week. The first chrysin-treated group received the drug (25mg/kg body weight) orally on a daily volume of 0.1 ml for one week. The second chrysin-treated group received the drug (50mg/kg body weight) orally on a daily volume of 0.1 ml for one week. The 6th group received 1mg/kg methandienone received an additional oral treatment with chrysin (25mg/kg) for one week. The 7th group received 1mg/kg methandienone received an additional oral treatment with chrysin (50mg/kg).

Results: The results showed clear changes in blood parameters in treated animals, represented by significant reduction in the counts of total leucocyte, monocyte, eosinophil and neutrophil, associated by significant increase in the counts of lymphocyte, red blood cells, and blood counts, as well as hemoglobin level.

Conclusion: methandienone causes change in blood parameters and chrysin play an ameliorative effect of methandienone. Additionally, treatment with chrysin for short period was able to reduce these side effects of treatment with methandienone.

Keywords: methandienone, chrysin, cyclophosphamide, complete blood tests, mice

Introduction

Methandienone is one of the anabolic androgenic steroids which is known as a testosterone derivative¹. Methandienone, in addition to its reported enhancement of protein metabolism and synthesis, is an anti-anemia drug that can stimulate production of red blood cells (RBCs) synthesis. Hence, it has been applied in treatment of aplastic anemia, corneal ulcer and wounds².

Complementary supplemetations are used to be consumed in combination with drugs like methandienone in order to reduce their side effects. Chrysin belongs to a group of flavonoids with a wide biological activities, which was used in the traditional medicine and comprise the main component of several medical plants such as Radix scutellariae, Passiflora incarnate, and Pelargonium crispum. They were also described as constituents of propolis, honey, and mushrooms. Chrysin was proved to have several strong medicinal anti-inflammatory activities, anti-asthmatic and antioxidant activities, as well as protective effects against diseases of organs such as the heart, brain, lungs, kidneys and liver, where its activity depended on its bioavailability and solubility. Chrysin experts its activities through strong antitoxic characteristics against induced toxins, such as methotrexate, ethanol, D-galactosamine in the liver, doxorubicin in the heart, adenine and ethanol in the kidney, ovalbumin, bleomycin and cigarette smoke in the lungs, and formalin in the nervous system³. Therefore,
Chrysin is considered as an anti-cancer, anti-aging, anti-hypertensive agent with a liver-protective role against chemotherapeutic\textsuperscript{4, 5}. In the present study, the effects of methandienone on blood was investigated and compared to those of normal and chrysin supplementation conditions in Mus musculus.

**Method**

**Chemicals:** Methandienone was purchased from LA Pharma S.r.l. (Thailand). Cyclophosphamide (CFA) was purchased from Zydus (Germany). Chrysin (CR) was purchased from Sigma-Aldrich (China). The other chemicals and reagents were used at analytical grade level.

**Drug Doses:** Daily doses of 0.1 ml methandienone were given to the mice with 1 mg/kg body weight. Chrysin doses 25 mg/kg and 50 mg/kg were prepared depending on previous studies\textsuperscript{6}.

**Laboratory Animals:** Male Mus musculus mice (8-12 weeks in age, 25.00 ± 2.00 gm Wight) were acquired from the National Centre of Monitoring and Medicinal Research, Ministry of Health, Baghdad, Iraq. They were kept in standard cages (25°C) with food and water provision ad libitum in the animal house, Biotechnology Branch, Applied Sciences Division, University of Technology, Baghdad. The animals were maintained, and used by “Guide for the Care and Use of Laboratory Animals,” which was approved by the University of Technology (Baghdad, Iraq), Animal Ethical Committee.

**Experimental Design:** Seven experimental groups, each with 5 mice, were set as follows. The negative control group was treated with distilled water. The positive control group was treated with 20mg/kg of the carcinogenic and mutagenic drug cyclophosphamide (CFA) twice a week for two weeks. Methandienone-treated group received the drug (1mg/kg body weight) orally on a daily volume of 0.1 ml for one week. The first chrysin-treated group received the drug (25mg/kg body weight) orally on a daily volume of 0.1 ml for one week. The second chrysin-treated group received the drug (50mg/kg body weight) orally on a daily volume of 0.1 ml for one week. A group of mice that was already treated with 1mg/kg methandienone received an additional oral treatment with chrysin (25mg/kg) for one week. Another group of mice that was already treated with 1mg/kg methandienone received an additional oral treatment with chrysin (50mg/kg). Mice from all groups were directly sacrificed after the 7 days of treatment and samples blood were collected from the heart.

**Blood tests**

**Total WBC Count:** Hemocytometer was used to count the cells according to Brown method. Mice were first anesthetized with chloroform and a 1 ml sterile syringe was used to collect blood from the left ventricle\textsuperscript{2} Next 0.02 ml blood was added to 0.38 ml of the dilution solution, followed by thorough mixing. 1 drop of the mixture was mounted on the slide for 2 minutes before counting the cells based on the formula:

\[
\text{WBCs count per mm}^3 = \frac{\text{no of WBC counted } \times \text{blood diluting factors}}{\text{chamber depth } \times \text{area of counted chamber}}
\]

\[
\text{WBC per mm}^3 = \frac{\text{white cells } \times 20}{4 \times 0.1 \text{ mm}^3}
\]

\[
\text{WBC per mm}^3 = \text{white cells } \times 50
\]

**Absolute WBC Count:** Haem method was adopted to conduct this measurement. A homogenous blood smear was made on a slide which was then fixed with alcohol and stained in Leishman stain. Light microscope with 100X magnification was used to examine the slides, where random count for 100 leucocytes was performed for percentage extraction absolute number calculation as in the formula:

\[
\text{Cell Number (cell/mL) = } \frac{(\text{total WBC count } \times \text{cell type percentage})}{100}
\]

**Total RBC Count:** 0.02 ml of Blood was mixed with 4 mL of Hymes fluid in a clean test tube by well shaking. One drop of the mixture was mounted on a counting slide for 2 minutes before examination under 40X magnification. RBCs count was performed in 5 small squares within the middle large square of the counter and the final count was calculated based on the formula:

\[
\text{Total count (cell/L) = } \frac{(\text{cells counted } \times \text{dilution factor } \times 10^9)}{\text{volume}}
\]

**RBCs mean corpuscular volume (MCV):** Blood was allowed to flow in a capillary tube that has 15mm left on vacuum. After closing an end of the tube, and then centrifuged (11,000 rpm; 5 minutes) and a Haematocrit Reader was used to read the PCV. Femtoliter (FL) was then used to calculate MCV as in the formula:

\[
\text{MCV (FL) = PCV/Red cell count per liter } \times 10
\]

**Blood Platelets Count:** Platelets number was determined based on the formalin citrate method. One gm of ammonium oxalate was dissolved in 1 mL DW to prepare the dilution solution which was filtered and kept in the refrigerator until use. In EDTA test tube, 20 μL
of blood was mixed well by shaking with 380 µL of the diluent and left for 10 minutes to ensure complete lysis of RBCs. One drop of the mixture was covered with a cover slip on a counting chamber which was entirely transferred in a closed Petri with wet cotton to prevent from draught and pollution. After for 20 minutes in the dish, platelets count was performed using the RBC counting squares in the chamber. The following formula was used for calculation:

\[
\text{Total number of platelets} = \frac{\text{number of platelets counted in 5 squares}}{1000}
\]

**Hemoglobin Measurement**: After preparation, Drabkins solution was diluted (1:10) using DW, then 1 mL of which was mixed well by shaking with 20 µL of whole blood. The mixture was then kept for 5 minutes (room temperature) before measuring the concentration of hemoglobin through reading absorbance at 540 nm.

**Statistical Analysis**: The obtained data were shown as mean ± standard error (SE) for all groups and subgroups. The differences were estimated between the control negative group and the mean values of each group by extracting the value of the t-test. P < 0.05 was statistically significant.

### Results

**Table 1: Effects of Chrysin and Methandienone on WBCs, Neutrophils, Lymphocytes, Monocytes and Eosinophils**

<table>
<thead>
<tr>
<th>Groups</th>
<th>WBCs</th>
<th>Neutrophils</th>
<th>Lymphocytes</th>
<th>Monocytes</th>
<th>Eosinophils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Control</td>
<td>8.18 ± 0.08*</td>
<td>37.50 ± 1.02**</td>
<td>57.67 ± 1.60**</td>
<td>2.37 ± 0.18*</td>
<td>1.80 ± 0.20*</td>
</tr>
<tr>
<td>Positive Control (CFA)</td>
<td>4.14 ± 0.30</td>
<td>54.50 ± 0.58</td>
<td>43.50 ± 1.00</td>
<td>1.33 ± 0.33</td>
<td>0.10 ± 0.33</td>
</tr>
<tr>
<td>CR 25 mg/kg</td>
<td>6.88 ± 0.30*</td>
<td>33.00 ± 1.74</td>
<td>65.67 ± 3.97</td>
<td>1.00 ± 0.32*</td>
<td>0.20 ± 0.20**</td>
</tr>
<tr>
<td>CR 50 mg/kg</td>
<td>5.18 ± 0.42**</td>
<td>37.33 ± 1.02</td>
<td>60.17 ± 0.51</td>
<td>2.25 ± 0.58</td>
<td>0.25 ± 0.25*</td>
</tr>
<tr>
<td>Methandienone 1 mg/kg</td>
<td>5.67 ± 0.14**</td>
<td>23.50 ± 1.45**</td>
<td>74.00 ± 1.16**</td>
<td>2.33 ± 0.33</td>
<td>0.15 ± 0.22*</td>
</tr>
<tr>
<td>(Methandienone 1+CR25)</td>
<td>6.75 ± 0.45</td>
<td>31.50 ± 0.50**</td>
<td>65.50 ± 0.50**</td>
<td>2.20 ± 0.38</td>
<td>0.60 ± 0.40</td>
</tr>
<tr>
<td>(Methandienone 1+CR50)</td>
<td>7.92 ± 0.95</td>
<td>32.25 ± 1.50*</td>
<td>66.00 ± 1.00**</td>
<td>1.25 ± 0.25</td>
<td>0.50 ± 0.29</td>
</tr>
</tbody>
</table>

**P<0.01, *P<0.05, Data presented as mean ± SE**

**Table 2: Effects of Chrysin and Methandienone on RBCs, Hemoglobin, PCV, and Platelets**

<table>
<thead>
<tr>
<th>Groups</th>
<th>RBCs</th>
<th>Hb</th>
<th>MCV</th>
<th>Platelets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Control</td>
<td>6.85 ± 0.06**</td>
<td>11.30 ± 0.16*</td>
<td>52.90 ± 0.80*</td>
<td>794.71 ± 16.65**</td>
</tr>
<tr>
<td>Positive Control (CFA)</td>
<td>5.23 ± 0.20</td>
<td>8.79 ± 1.07</td>
<td>50.10 ± 0.30</td>
<td>487.83 ± 15.15</td>
</tr>
<tr>
<td>CR 25 mg/kg</td>
<td>8.15 ± 0.33*</td>
<td>12.67 ± 0.54</td>
<td>51.10 ± 0.50</td>
<td>1077.00 ± 64.77**</td>
</tr>
<tr>
<td>CR 50 mg/kg</td>
<td>8.30 ± 0.69</td>
<td>13.25 ± 1.26</td>
<td>51.40 ± 1.00</td>
<td>1101.00 ± 71.61*</td>
</tr>
<tr>
<td>Methandienone 1 mg/kg</td>
<td>7.72 ± 0.13**</td>
<td>12.20 ± 0.45</td>
<td>55.85 ± 0.75</td>
<td>1002.80 ± 37.79*</td>
</tr>
<tr>
<td>(Methandienone 1+CR25)</td>
<td>7.28 ± 0.30</td>
<td>11.08 ± 0.38</td>
<td>50.40 ± 0.31**</td>
<td>1294.75 ± 220.10</td>
</tr>
</tbody>
</table>

**P<0.01, *P<0.05, Data presented as mean ± SE**

### Discussion

**Effects of Chrysin and Methandienone on WBCs, Neutrophils, Lymphocytes, Monocytes and Eosinophils**: Table 1 shows a significant decrease in the counts of total WBCs, lymphocytes, monocytes, and eosinophils as well a significant increase in those of neutrophils in the blood from CFA-treated mice as compared to the negative control. A significant decrease was also observed in counts of WBCs, neutrophils (p<0.05) and eosinophils (p<0.01) in mice treated with 25mg/kg CR as compared to the negative control. Mice treated with 50 mg/kg CR showed significant decrease in counts of WBCs (p<0.01) and eosinophils (p<0.05) as compared to the negative control. Methandienone-treated mice showed significant decrease in counts of WBCs, neutrophils (p<0.01) and eosinophils (p<0.05) with significant increase in lymphocytes (p<0.01) in comparison to the negative control. The results also demonstrated significant increase in neutrophils.
and increase in lymphocytes for mice treated with methandienone + 25 mg/kg CR as compared to those treated with methandienone alone (p<0.01). In mice treated with methandienone + 50 mg/kg CR, a significant increase in counts of neutrophils (p<0.05) and decrease in lymphocytes (p<0.01) were observed as compared to those treated with methandienone alone.

One possible explanation for the increase in lymphocyte counts of mice treated with methandienone is that the drug might have caused inflammatory reactions that were reported to result in elevated frequency of lymphocytes\(^9\). Anabolic androgenic steroids (AAS) were reported to exert immunosuppressive impacts\(^9\), while another investigation showed that these compounds enhance the immune function\(^10\). However, the nature of their effects depends on the kind of AAS used as well as the dose and period of treatment.

The present results also demonstrated that treatment with both concentrations of chrysin caused a reduction in the negative effects of methandienone, through the observed increase in the counts of WBCs and neutrophils and the decrease in lymphocytes in mice treated with methandienone + chrysin. This effect might be due to the high antioxidant effect of chrysin, since several studies showed this important in vivo effect from propolis and flavonoids and their many vital biological activities, including the effects on the antioxidant enzymes as well as their immune stimulation impacts\(^11,12\).

**Effects of Chrysin and Methandienone on RBCs, Hemoglobin, MCV, and Platelets:** The results in table 2 showed significant decrease in the numbers of RBCs and blood platelets, levels of Hb and average PCV in mice treated with CFA as compared to the negative control. In contrast, the two groups of mice treated with 25 mg/kg CR and 50 mg/kg CR demonstrated increased parameters of RBCs, HB and platelets as compared to the negative control, with the increase being significant for RBCs count (p<0.05).

Mice treated with methandienone showed increase in RBCs, Hb, platelets and MCV as compared to the negative control, with the increase being significant for RBCs (p<0.01) and platelets (p<0.05). In contrast, treatment with methandienone + 25 mg/kg CR resulted decrease in parameters of RBCs, Hb and MCV and an increase only in platelets as compared to treatment with methandienone alone, with the difference being only significant for MCV (p<0.01). Treatment with methandienone + 50 mg/kg CR resulted in insignificant increase in RBCs and Hb, significant increase in platelets (p<0.05), and significant reduction in MCV (p<0.05) as compared to treatment with methandienone alone.

The significant increase in RBCs and platelets in the blood of methandienone-treated mice can most possibly be attributed to the effects of this drug as an AAS, since these steroids were reported to stimulate the hormone Erythropoietin which functions on increasing RBCs production and Hb concentration\(^13,14\). The elevated production of RBCs is a risk factor for cardiovascular diseases, and consumption of anabolic steroids was correlated to development of angina pectoris and stroke in athletes, possibly due over production of blood platelets that play effective roles in these diseases. It was reported that consumption of AAS by weight-lifting athletes correlated with increased platelet count that cause thrombosis\(^15,16\).

Treatment of mice with chrysin was found in the present study to cause increases in WBCs and Hb. These results were possibly due to the reported effects of this drug on blood parameters, including its single-dose reduction of RBCs and Hb and development of hypo chronic anemia, indicating iron and vitamin B12 deficiency as well as oxidative stress\(^8\). We conclude from these results that consuming chrysin in multiple doses might enhance absorption of iron and vitamin B12 as well as erythropoiesis.

**Conclusion**

The present study concludes that methandienone causes change in blood parameters and chrysin play an ameliorative effect of methandienone. Therefore, taking methandienone must follow medical supervision for determination the period of treatment and dose. Treatment with chrysin for short period was able to reduce these side effects of treatment with methandienone.

**Acknowledgment**

The authors are thankful to the management of Biotechnology Division, University of Technology for providing basic facilities for this research work.

**Conflict of Interest:** None

**Ethical Clearance:** The study and all its procedure were done in accordance with the Helsinki Declaration of 1975, as revised in 2000. The study was approved by Applied Science Department, University of Technology.

**Source of Funding:** The work were supported by authors only
REFERENCES


Mixed Methods: Expectations Versus Facts on the Implementation of Adolescent Care Health Service

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ABSTRACT
Percentage of adolescents in Indonesia nearly reaches 30% of the total population. This amount is relatively huge and able to be the nation’s asset, if it is managed properly. Various adolescent reproductive health programs have been conducted in diverse sectors—governmental or even non-governmental. One of which is called the Adolescent Care Health Service (ACHS). This research aims to identify adolescent expectations and facts on ACHS program implementation. Research methods were used mixed methods. Quantitative data were collected from 842 respondents (high school students in Surabaya, Indonesia) from questionnaires, while qualitative data were collected from interviews with quantitative respondents at the same time using purposive random sampling. Data analysis was also conducted with the mixed methods using quantitative and qualitative descriptive, based on the data and information collected. Research results showed that 76.2% did not know the existence of ACHS program and 90% had never accessed the program. Qualitative data implied that adolescent hoped for an adolescent health program which fitted adolescents’ characteristics, needs and capacities; for instance, one which utilized entertaining method and media. However, in fact, the method and media used had a patronizing tendency and based on the informants were very boring and moreover, the adolescents’ involvement in the program planning was only 8.4%. According to the ACHS implementation national standard, adolescents need to be involved starting from planning to evaluation of the program. In addition to that, the ACHS program is supposed to be adolescent-friendly—fit the adolescent needs.

Keywords: Expectations, Facts, Implementation, Program, ACHS.

Introduction
Adolescents according to WHO are those at the age of 10-19 years old and demographically divided into two age groups; for 10-15 and 15-19 years old. Based on the data of Indonesia Population Projection 2000-2025, proportion of 10-19 years old adolescent population in 2010 is approximately 18.3% from the total population, or about 43 millions. The amount of adolescent age group populations may be interpreted as the nation’s future asset and potential. However, in order to fulfill these expectations, the nation and the society must be able to assure that Indonesian adolescents can grow and develop positively, and are free from various threatening problems.¹

Care for adolescents’ problems in Indonesia has been fostered, although it still has many shortcomings. Strategy to conduct the adolescent health policy is carried by the government through cross-sectional cooperation, fundamental health service and its referral, and intervention pattern. This strategy undoubtedly has been adjusted to the needs of adolescent growth and development.² Since 2003, the Health Ministry has developed a adolescent health program with a specialized approach known as Adolescent Care Health Service (ACHS). Adolescent Care Health Service (ACHS) is a model of health care for adolescents in primary health care services. ACHS is a policy to improve the adolescents’ health. This approach aims to encourage providers, particularly Public Health Centres, to be able to give health services which are comprehensive, compatible and fulfilling to the needs of adolescents who hope for privacy, recognition, value and involvement; in planning, execution, to evaluation of the program.

In 2014, a national standard guidebook was prepared as a reference in the implementation of ACHS,
which was in accordance with the needs of adolescents. The guidebook was arranged for the people in charge of ACHS in national, provincial, district/city level and particularly Public Health Centres, in order to conduct the ACHS with a good and adolescent-friendly quality. This program which is directed to adolescents, is absolutely going to be judged by the adolescents; how far the program has been carried out and affected them. This research aims to analyze adolescents’ expectations and facts on the implementation of ACHS program.

Materials and Method

The empirical component of this article derives from interviews with senior high school adolescents in Surabaya, Indonesia. The interviews were concerned to their practices in relation to and in view of this research which combines quantitative and qualitative approaches.

This research involved 842 senior high school students in total, which some were then chosen through purposive random sampling for qualitative data collection purpose. All respondents were given questionnaires about evaluation of ACHS program implementation, then the respondents which had become peer educators were chosen to be the informants. The chosen informants out of the 842 quantitative respondents were 27 students. These informants had been given a training as peer educators from various sectors of the government and also non-government since 2016. Researcher had asked for the expectations and evaluations on ACHS program to these informants. Data analysis was also conducted with mixed methods through frequency distribution descriptive and content analysis.

Findings

Implementation of Adolescent Care Health Service (ACHS) program: Table 1 showed that half of the respondents were female (58.4%) with the average age of 15-16 years old respondents were in the first and second grade of senior high school.

<table>
<thead>
<tr>
<th>Table 1: Respondents’ Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Adolescents’ knowledge regarding to ACHS program. Based on the table 2, it was known that 76.2% of the adolescents had not known about the ACHS program.

<table>
<thead>
<tr>
<th>Table 2: Distribution of adolescents’ knowledge about ACHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescents’ Knowledge</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Table 3 displayed the distribution of adolescents who had received a peer counselor training. According to the data, it was known that only 25.8% had received the peer counselor training from the governmental or even the non-governmental sector (Health Ambassador by Health Department, Drug Ambassador by National Narcotics Department, Peer Educator by University, Counseling Information Centre/CIC by National Department for Planned Family and Population, Scout Creation Unit of Bakti Husada by Scout Coordinator, Peer Educator Training by Society Independent Institute of Indonesian Planned Family Assemble). After getting the peer counselor training, the adolescents did not carry their duty as peer educators out. The reason was because plenty of peer educators did not know what their duty was and moreover, they perceived that the implementation of the duty might interrupt the study hour at school. This was discovered from a statement of one informant who had become a peer educator, as follows:

“yes I know what the duty is, miss, but I’m afraid carrying it out will interrupt the study hour in class.”

Adolescents’ involvement in the program implementation. Based on these data, it was known that the adolescents involved in the program planning was...
only 8.4%, in the program implementation was only 8.6% and in the program evaluation was only 8.9%. This showed that the adolescents had not been involved maximally in the program implementation, whereas ACHS program was supposed to involve adolescents starting from planning to evaluation. The principles of adolescent health program are from, by and for the adolescents, according to characteristics, needs and capacities of them. This is encouraged by the policy and the system management which are able to assure and to increase ACHS quality through adolescents’ involvement.

### Table 4: Distribution of adolescents’ participation in ACHS program

<table>
<thead>
<tr>
<th>ACHS Program</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>71</td>
<td>8.4</td>
</tr>
<tr>
<td>No</td>
<td>771</td>
<td>91.6</td>
</tr>
<tr>
<td>Implementation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>72</td>
<td>8.6</td>
</tr>
<tr>
<td>No</td>
<td>770</td>
<td>91.4</td>
</tr>
<tr>
<td>Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>75</td>
<td>8.9</td>
</tr>
<tr>
<td>No</td>
<td>767</td>
<td>91.1</td>
</tr>
<tr>
<td>Advocacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>131</td>
<td>15.6</td>
</tr>
<tr>
<td>No</td>
<td>711</td>
<td>84.4</td>
</tr>
<tr>
<td>Total</td>
<td>842</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4 showed that 84% of the adolescents were not involved in the advocacy process. Even though ACHS was a program for the adolescents, but their participation in the program was still minimal.

### Adolescents’ Expectations and Facts on the Implementation of Adolescent Care Health Service (ACHS) Program:

Adolescents’ expectations and facts regarding to the implementation of ACHS program were collected from researcher’s interviews with informants who had become peer educators and also adolescent representatives who were the targets of the peer educator program in the community. These peer educators had not involved maximally in the strategic steps implementation of ACHS, and moreover, had not known about the ACHS. These can be shown from the statements below:

**Question on problem identification**

“...we hope it’ll be like that, miss, we actually need that, since adolescents are different, they want various things...the activity is supposed to fit what the adolescents want...we still don’t know what to do. miss, we plan to assemble in May...”

**Question on ACHS Implementation**

“...we haven’t heard about ACHS, miss...”

“...it needs to be assembled, which fits adolescent characteristics, knows how to approach the adolescents...”

These statements might also show that the adolescents still were not aware of the term ACHS. According to them, it was known that peer educators were hoping for an adolescent reproductive health service with facilities and activities needed by the adolescents, such as activities favored by them (music-related), hangout places (free-wifi area, cafe) and a small library. The service procedures were hoped to be simple with a chill atmosphere.

“...it’s needed, we’ll adjust the activities according to the booming problems...the data have to be collected as references for alternative solutions...we’ve done surveys about adolescents’ health problems in several schools...”

Adolescents were very supportive if they were actively involved starting from planning to evaluation. The adolescents are those who know about adolescents’ health problems and how to prevent them. This is parallel to the principle of adolescent health program, which is from, by and for the adolescents. However, in fact, the friends of peer educators were not aware of ACHS program and after they received the training, they still did not know about their duty as peer educators. These are known from the statements below:

**Question on Socialization**

“...ACHS...I’ve heard about it but not in details. We’ve never received a socialization for this activity...”

“...What we know is that Public Health Centre is for sick people. I usually go to Public Health Centre to get a health certificate for competition...”
Question on the Role of Peer Educator
“...peer educator is very important, to inform the friends about the right thing...if there is a friend that asks me, then I’ll answer...”
“...Public Health Centre had come (here) to conduct a socialization, but Public Health Centre never informed about ACHS...”

Question on Monitoring and Evaluation
“...us, fellow PE, after being trained we’ve never been contacted by the Health Department, the advice was not to do sex before marriage...”
“...we’d received a socialization from the Health Department but it was 2 years ago. This activity is supposed to be conducted routinely every year...”
“...the form of socialization media is usually in PPT, miss; our suggestions are comic, TV show which is educative, or it can be an online game....”

Based on those statements, it was known that the adolescents were not aware of ACHS program, the adolescents’ knowledge on Public Health Centre is about service for healing, a socialization was received from the Health Department but was not conducted routinely. The adolescents hoped that in order to conduct a socialization routinely and equal at all schools in Surabaya, the expected media were audiovisual media and attractive media like comics, educational shows on TV, and furthermore, one suggested for an android application—online game.

Discussion

Adolescent Care Health Service (ACHS) is a model of health care for adolescents in Public Health Centre. The amount of adolescents served by Public Health Centres in Surabaya has not reached 50% yet. The data were collected from the amount of adolescents who visited Public Health Centres. Based on these data, an information is obtained, that most of the adolescents coming to Public Health Centres aimed to get medical services. This could be shown on the mostly served case data, which were other cases, not Reproductive Health cases.

According to the person in charge of ACHS at one Public Health Centre in Surabaya, adolescents had never accessed the Public Health Centre for information service, counselling. Data of Public Health Centre about the amount of adolescents’ problems (STD, HIV, Unwanted Pregnancies) were collected from the adolescents who visited Public Health Centres with getting treatments as their initial purpose. Whereas the kinds of ACHS service include the provision of mother and child health, counselling, medical treatment, peer educator training and referral.

Based on the health profile of the Health Department in 2016, Public Health Centres with adolescent care health service had been established at all Public Health Centres in Surabaya. The ACHS activities there in 2016 were counselling, nutrition service, reproductive health and knowledge about HIV-AIDS, narcotics, psychotropica and addictive substances, and many others.

Ningsih (2018) stated that it was needed an integrated service post for adolescents which had its distict flow for adolescent service. Adolescents received information so that they understand their needs to live healthy and productively. Therefore, adolescents might utilize various kinds and places of health service according to their needs. Research results showed that most of the adolescents were not aware of the ACHS program. Adolescents also stated that 90% of them had not received any exposure to the ACHS program, whereas 55% had experienced counselling in Public Health Centre. These showed that adolescents were not aware that counselling was a part of ACHS program.

Muthmainnah (2013) stated that nowadays adolescents were only the objects of the program and not the subjects yet. This caused the adolescents unable to actively participate in the program. One of the activities which might cause adolescents to have an active participation in it was the peer counselor activity. However, 76% of the adolescents also stated that they were not trained by the peer counselor.

Establishment and functionality of network among the adolescents, society groups, related cross sectors and society independent institutions in the provision and utilization of ACHS. Most of the adolescents stated that they did not participate in planning, program activities and evaluation of ACHS. These showed that the adolescents’ role in the program was still minimal. ACHS was a program directed to adolescents, but the adolescents still had no role in the program. With these results, network of ACHS program in Surabaya had not fulfilled the established standard yet.
Based on the research results, it was obtained that the majority of the adolescents did not participate in the advocacy activity of ACHS program. This implied that the health management which had been conducted all this time still had not based on the needs of the particular adolescents, since the adolescents did not participate in the management.

Research on the implementation of Adolescent Care Health Service (ACHS) (A case study in West Sumbawa District) with research subjects as follows: Head of Maluk Public Health centre, staff in charge of ACHS, adolescents, Head of Health Service Division in Health Department of West Sumbawa District. Based on the research results, it was known that the ACHS activities were still limited to socialization at school with Adolescent Reproductive Health topic. The adolescents who visited the Public Health Centre had not received services according to the flow of the Health Department’s ACHS service model.

Adolescents’ access to Public Health Centre was still crashed with the school hour. Public Health Centre had not conducted peer counsellor training. There were no enough allocation money for ACHS activities. The ingredients for socialization were still lacking, there were no service form, guide for counselling and implementation, tools for educative learning and transportation also room for service. Workers’ understanding about the program was still lacking. Not all workers behaved adolescent-friendly and had positive attitude in achieving goals. Workload of the workers was high. Supervision was only in form of report checking. The report’s quality was still low. Forum of cross sectoral cooperation had not utilized to collect supports for the execution of ACHS. Standard Operating Procedure and Minimum Service Standard were not available. It can be concluded that the implementation of ACHS in Public Health Centre has not fulfilled the criteria of adolescent service as established by the Health Department of Indonesia, because of the inadequacy of fund support, facilities and infrastructure, human resources and coordination activity also bureaucracy structure. So, it is recommended to continue the policy of ACHS modification which can be accepted by the adolescents; the topic, time and service flow.5

Conclusions

Adolescents were not involved in the planning of ACHS activities. The adolescents were only objects of the program, not the subjects. Although the adolescents were aware of the risky behaviors and their effects thus they felt the need for adolescent health program, however they were still not aware of ACHS program because they had never been involved in it. Adolescents are supposed to be the pioneer of adolescent health program (from, by and for the adolescents) thus they need to say to the stakeholders (decision maker and provider) that there are: adolescents’ problems, experience by themselves or others; need for adolescent health program; availability of adolescents to be actively involved in the implementation of ACHS program. The adolescents hope that there will be an adolescent health program which is in tune with the characteristics, needs and capacities of them.

Conflict of Interest: There is no conflict of interest in the study

Ethical Clearance: The study was received ethical approval from the Health Research Ethics Committee, Faculty of Nursing, Universitas Airlangga.

Source of Funding: Lembaga Penelitian dan Inovasi Universitas Airlangga

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Association between Strabismus and Refractive Errors among Preschool Children in Fallujah, Iraq

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ABSTRACT

Purpose: To investigate the association between concomitant esotropia and exotropia and refractive error among preschool children under age of 6 years in the city of Fallujah in western Iraq.

Method: In this cross-sectional study, 253 strabismic patients participated. After obtaining informed written consents, children underwent full ophthalmic examination, with uncorrected and corrected visual acuity and cycloplegic refraction. Strabismus was defined as; inward deviation esotropia and outward deviation exotropia of 10 or more prism dioptries.

Results: Of these 253 cases, 14 were excluded because of poor cooperation, older age and missed information. Prevalence of esotropia and exotropia were 81.2% and 18.8% respectively. There was a higher prevalence of esotropia in boys and exotropia in female (p = 0.180). Multiple logistic regression analysis revealed a significant relation between refractive error and strabismus (p = 0.268). The prevalence of amblyopia among strabismic cases was 57.3%.

Conclusion: This study found a strong association between refractive error and horizontal strabismus among the preschool children in Fallujah in west of Iraq. These results can help in setting a guideline on early correction of refractive errors to prevent strabismus and amblyopia development.

Keywords: Strabismus; Refractive errors; Amblyopia; Preschool children; Fallujah; Iraq

Introduction

Strabismus, a manifest misalignment of one or both eyes, is a common childhood ocular disorder with an estimated prevalence of 2.3% to 6.0% in general population [1, 2, 3]. Strabismus affects the harmonization between the two eyes, leading to the impairment of binocular vision and depth perception [3], and subsequent amblyopia development [4]. Amblyopia is considered as a leading cause of unilateral visual loss in both children and adults, with a doubling risk of bilateral visual impairment [5]. In addition to the effect of squint on the visual function, there are also psychosocial aspects that affect the self-image [6, 7, 8], the interpersonal relationships [9], and the social prejudice [3, 10], as well as its effects on the school performance [11].

The exact underlying pathogenesis of strabismus has not been fully established. It has been suggested that various risk factors early in life play roles in strabismus development, such as prematurity, maternal smoking during pregnancy, Down’s syndrome, family history, gender and different ethnicities [3, 12, 13]. Furthermore, refractive error, such as hyperopia, astigmatism and anisometropia, have been reported or suggested to be related to strabismus [3].

Since refractive errors are considered as correctable or modifiable risk factors in the development of squint [1], it is important for the eye care providers to confirm these relations as it can provide information about strabismus pathophysiology; as well as setting a guideline on the
management of refractive error in order to prevent strabismus development and subsequent amblyopia \(^1\) \(^{14}\). By detecting amblyopia and initiating treatment at a young age, it will lead to better visual outcomes \(^9\). Also, the early diagnosis and correction of strabismus will help in achieving normal socialization \(^9\).

Population-based and hospital-based and studies concerning the prevalence of strabismus and its related risk factors are not readily available in Iraq. So, in this study, we had two main aims: first, to investigate the association between concomitant esotropia and concomitant exotropia and refractive error in Iraqi preschool children, and second, to assess the prevalence of amblyopia in these patients.

**Materials and Method**

A hospital based cross-sectional study was conducted at the Ophthalmology outpatient clinic at Fallujah Teaching Hospital in Anbar governorate, west Iraq. The study was carried out from the period of July 2018 to December 2018. During this period, all the cooperative preschool child under the age of 6 years with concomitant horizontal strabismus who visited the ophthalmology clinic at our hospital, were included in our study. Subjects with vertical tropias, ocular motility disorders, other ocular pathologies or history of strabismus corrective surgery, were excluded. All the medical procedures were performed after obtaining the ethical approval, and respected the Declaration of Helsinki. Signed informed consents were obtained from the children’s parents or guardians.

**Examinations:** All the participants underwent full ophthalmic examination by trained ophthalmologists and optometrists including ophthalmic history, monocular uncorrected visual acuity (UCVA) and best corrected visual acuity (BCVA). The VA testing was done using either Catford drum, Kay pictures cards or Snellen’s (E letter) chart according to the age of the child. Since the accommodation may affect the results, cycloplegic refractions were carried out using 1% Cyclopentolate topical drops \(^15\). The presence of strabismus was diagnosed by performing cover/uncover test and alternating cover test at near and distance fixation targets with and without spectacles correction, and the degree of squint was measured by a prism bar \(^1\) \(^8\). During the ophthalmic examination of these children, the presence or absence of amblyopia was also noted and any history of occlusion therapy was asked. The findings were recorded in a self-designed proforma consisting of the patient profile, strabismus type, visual acuity, and refractive errors of both eyes.

**Definitions:** For the purpose of this study, normal VA was defined as an uncorrected VA equal to or better than 6/6 in the better eye. Amblyopia was defined as initial BCVA of 6/9 or worse, or at least two Snellen lines difference between the ambyopic and the fellow eye, in the absence of ocular pathology in either eyes \(^1\) \(^6\). Diagnosis of strabismus was defined as any manifest intermittent or constant horizontal tropia of 10 or more prism dioptres \(^1\). Myopia was defined as a refraction of -0.50 D or less. Hyperopia was defined as a refraction of +0.5 dioptres (D) or more; low hyperopia was considered for refraction of +0.50 to <=2.00 D, and significant hyperopia was considered for refraction of >= +2.00 D. Astigmatism was defined as a cylinder of >= 0.5 D, and anisometropia is an interocular difference in refraction of 1 D or more \(^17\) \(^18\).

**Statistical Analysis**

The participants were grouped as follow: children with esotropia and children with exotropia. The squint type was dependent variable, while age, gender, type of refractive error, presence of amblyopia were independent variables. These variables were analysed separately using binary logistic regression. Odd ratios (OR) and 95% confidence intervals (95% CI) were calculated to evaluate the relations of these variables with concomitant esotropia and concomitant exotropia. P-value less than 0.5 was considered as a significant result. All the data analyses in the current study were performed using SPSS software (IBM, version 21) for Microsoft Windows.

**Results**

A total of 253 patients were enrolled in this study. 14 subjects were excluded from the data analysis because of poor cooperation, age above the 6 years old limit or missed information. Of those 239 remaining, 107 were boys (44.8%) and 132 were girls (55.2%). The mean age was 3.47 ± 1.55 (range 0-6) years, and there was no significant difference in strabismus prevalence between different age groups \((p = 0.654)\). A total 194 out of 239 participants had esotropia, while only 45 had exotropia. Figure 1 shows that esotropia was two and a half time more prevalent than exotropia.
Table 1 summarizes the prevalence of different types of squint by age and gender. The overall prevalence of esotropia was 81.2%; 46.9% and 53.1% in boys and girls respectively. Based on the results of multiple logistic regression model in Table 2, esotropia prevalence significantly associated with SE hyperopia $\geq$ 2 D ($p = 0.215$), and astigmatism ($p = 0.319$). Exotropia was detected in 18.8% of the studied sample, and as showed in Table 1, the prevalence was higher in females (64.4%) than in males (35.6%). Multiple logistic regression identified SE hyperopia of 2 or more D as an associated risk factor ($p = 0.252$).

**Table 1: The prevalence of esotropia and exotropia in strabismic subjects by age and gender**

<table>
<thead>
<tr>
<th></th>
<th>Esotropia</th>
<th></th>
<th>Exotropia</th>
<th></th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>194</td>
<td>81.2</td>
<td>45</td>
<td>18.8</td>
<td>239</td>
<td>100</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>91</td>
<td>46.9</td>
<td>16</td>
<td>35.6</td>
<td>107</td>
<td>44.76</td>
</tr>
<tr>
<td>Female</td>
<td>103</td>
<td>53.1</td>
<td>29</td>
<td>64.4</td>
<td>132</td>
<td>55.23</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 1</td>
<td>4</td>
<td>2.06</td>
<td>2</td>
<td>4.44</td>
<td>6</td>
<td>2.5</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>9.79</td>
<td>3</td>
<td>6.66</td>
<td>22</td>
<td>9.2</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>18.55</td>
<td>9</td>
<td>20</td>
<td>45</td>
<td>18.8</td>
</tr>
<tr>
<td>3</td>
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<td>19.07</td>
<td>7</td>
<td>15.5</td>
<td>44</td>
<td>18.4</td>
</tr>
<tr>
<td>4</td>
<td>34</td>
<td>17.5</td>
<td>12</td>
<td>26.66</td>
<td>46</td>
<td>19.25</td>
</tr>
<tr>
<td>5</td>
<td>49</td>
<td>25.25</td>
<td>7</td>
<td>15.5</td>
<td>56</td>
<td>23.4</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
<td>7.7</td>
<td>5</td>
<td>11.11</td>
<td>20</td>
<td>8.36</td>
</tr>
</tbody>
</table>

Abbreviation: n, number

**Table 2: Association between esotropia and exotropia with age, gender and refractive error**

<table>
<thead>
<tr>
<th>Variables</th>
<th>OR (95%CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Esotropia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>1.029(0.828–1.279)</td>
<td>0.795</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>1.59(0.81–3.15)</td>
<td>0.176</td>
</tr>
<tr>
<td>Refractive error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low hyperopia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High hyperopia</td>
<td>1.61(0.75–3.44)</td>
<td>0.215</td>
</tr>
<tr>
<td>Myopia</td>
<td>0.5(0.12–2.06)</td>
<td>0.643</td>
</tr>
<tr>
<td>Astigmatism</td>
<td>0.5(0.128–1.95)</td>
<td>0.319</td>
</tr>
<tr>
<td>Anisometropia</td>
<td>1.15(0.406–3.27)</td>
<td>0.790</td>
</tr>
<tr>
<td>Age (year)</td>
<td>0.97(0.78–1.207)</td>
<td>0.781</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>0.62(0.31–1.24)</td>
<td>0.180</td>
</tr>
<tr>
<td><strong>Exotropia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refractive error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low hyperopia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High hyperopia</td>
<td>0.431(0.102–1.82)</td>
<td>0.252</td>
</tr>
<tr>
<td>Myopia</td>
<td>1.36(0.202–9.19)</td>
<td>0.750</td>
</tr>
<tr>
<td>Astigmatism</td>
<td>0.683(0.15–3.06)</td>
<td>0.619</td>
</tr>
<tr>
<td>Anisometropia</td>
<td>0.87(0.309–2.4)</td>
<td>0.807</td>
</tr>
</tbody>
</table>

Abbreviation: OR, odd ratio; CI, confidence interval; RF, Reference
The study also detected that 137 of the strabismic cases had amblyopia (57.3%) compared to 102 patients (42.7%) with no amblyopia. Of the 194 esotropia cases, 120 patients were amblyopic (61.9%). While only 17 exotropia patients out of 45 had amblyopia (37.1%). The strabismic amblyopia was the most common type of amblyopia (p = 0.058), accounting for 115 patients (83.9%), while the combined type (Aniso-strabismic amblyopia) found in only 22 patients (16.1%).

Discussion

The current study used a hospital-based cohort of children aged 0 to 6 years to investigate the association between refractive error and childhood concomitant strabismus. This study found that concomitant esotropia was the most common form among all the strabismus cases who attended our hospital clinic. This finding came in agreement with previous studies that reported convergence squint esotropia as the most common type of strabismus worldwide, constituting from a half to two thirds of all misaligned eyes [1, 19, 23]. However, in other studies in South East Asia [24] and in Brazil [26], exotropia was found to be more prevalent than esotropia. The reasons for these findings could be due to different races and ethnicities as suggested by Bruce and Santorelli [27]. Furthermore, esotropia cases in our study was more prevalent in females than in males. And this result agrees with the previous finding of Cotter and Colleagues [3] and Nusz and Colleagues [28] that reported significant association between esotropia and female gender.

An important finding in this study, is that the major risky refractive errors for concomitant esotropia were spherical equivalent (SE) hyperopia of 2.00 D or more and astigmatism of 0.50 D or more. For concomitant exotropia, SE hyperopia of ≥ 2 D was an associated risk factor. Several previous studies, in different countries around the world, have been done to identify the associations between different types of squint and refractive errors [3, 23, 29, 30].

In Multi-Ethnic Pediatric Eye Disease Study (MEPEDS) and Baltimore Pediatric Eye Disease Study (BPEDS) [3], esotropia was associated with hyperopia of ≥ 2 D and anisometropia; exotropia was associated with astigmatism of ≥ 1.5 D and anisometropia. In the study by Zhu and Colleagues [29], hyperopia of ≥ 2 D and anisometropia were associated with esotropia; and exotropia was associated with myopia, hyperopia and astigmatism. Sydney Myopia Study (SMS) [23] found that SE hyperopia of ≥ 3 D, astigmatism, myopia and anisometropia were associated with strabismus with no separate analysis for esotropia and exotropia. And Strabismus, Amblyopia and Refractive Error in Singaporean Preschoolers Study (STARS) [30], only astigmatism and anisometropia were related to strabismus, also without separate analysis for ET and XT. However, our current study did not find a significant relation between strabismus with anisometropia and myopia compared to the previous studies. The reason for these findings could be due to our small sample size compared to the large population and school-based studies which may affected the results.

Finally, our study found that the majority of strabismic patients (57.3%) have amblyopia which is more prevalent in esotropia cases. Previous studies in Iran [31] and Australia [32] have reported amblyopia in 23% and 37% of squint patients, respectively. Reasons for the high prevalence of amblyopia in strabismus patients found in our study are; poor compliance in glass wear due to the social stigma, and only 38% of the cases reported occlusion therapy for amblyopia.

There are a number of limitations in our study. Small sample size may play a role in our findings. Also, we did not attempt to classify strabismus by type and time of onset. And we only included age, gender, presence of amblyopia and associated refractive errors into the analysis. It is possible that there are other unknown factors may contribute to strabismus. Because that strabismus and refractive error confirmation was available only for the time of clinical examination, older children may have different refraction results from that at an earlier age when strabismus first occurred.

In conclusion, this hospital-based study of childhood strabismus found a strong link between refractive error and strabismus. This finding will be helpful for the eye care providers and parents in making informed decisions regarding management of early refractive error. However, further study with a larger sample is needed to clarify this relation between strabismus and refractive error, and to study the advantages of early correction of refractive error in preventing squint and amblyopia development.

Conflict of Interest: No conflict of interest from any of the authors.
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REFERENCES


Reflexology: A Modality in Manipulative and Body Based Method

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ABSTRACT

Reflexology is an ancient therapeutic treatment which activates the innate healing powers of the body by applying some pressure to the specific reflex points which are located on all part of the feet, hands, or ears. The popularity of reflexology therapy has increased in recent years as the public seek more holistic ways to maintain good health and well-being. This paper reviews and summarizes the existing literature on reflexology focusing on principle, concept, current issues and scientific evidence. Databases of PubMed, Scopus, Science Direct, Google scholar as well as ProQuest were the sources used for findings the articles. Collectively, these reviews suggest a number of areas where reflexology may well be beneficial. Recent evidence suggests that reflexology is a simple, less expensive and non-invasive method that effective to regulate the autonomic nervous system activities, coordinates physiological responses, alleviates anxiety, and induces body relaxation.

Keywords: complementary medicine; reflexology; review

Introduction

Complementary and Alternative Medicine (CAM) is a group of diverse medical and health care systems, practices, and products that are not presently considered to be part of biomedicine¹². The acronym of CAM encompasses the wide array of therapeutic, diagnosis, treatment, and preventive disciplines, which complement mainstream medicine by contributing to the diversifying of medical conceptual frameworks³. Developed nations were used the term of CAM to refer a diverse group of health-related therapies and disciplines which are not considered to be part of mainstream medical care⁴.

National Centre for Complementary and Alternative Medicine (NCCAM) classified CAM into four domains namely natural products including vitamins, herbs and supplements; mind-body medicine; manipulative and body-based practices; as well as other CAM practices such as traditional Chinese medicine, ayurvedic, and homeopathy². Manipulative and body-based practices focus primarily on the body structures and systems, including the bones, joints, soft tissues, circulatory and lymphatic systems⁵. It may be performed as a part of other therapies of whole medical systems, including chiropractic medicine, osteopathic medicine, massage, reflexology, yoga, tai chi and naturopathic medicine⁶. In the form of the manipulative and body-based therapy, reflexology has been practiced for over 4,500 years⁷.

Objective

The major aim of the study was to review the existing literature on reflexology and compile the facts.

Method

The systematic search for relevant literature was performed using five databases including PubMed, Scopus, Science Direct, Google scholar and ProQuest. The basic search terms used included traditional medicine, complementary medicine, integrative medicine and reflexology in order to facilitate search of literature. In order to obtain the widest range of studies, no limit was set for the date of publication. Only articles using English as a language of publication were included in the review.

What is Reflexology?

Definition of Reflexology: Reflexology is a complex massage intervention, based on the concept that specific areas of the feet, hands or ears which are called reflex points correspond to specific internal organs within the body⁸⁹. Reflexology consists of identifying and treating energy imbalances in the body through massage of reflex points in specific areas¹⁰. By applying pressure on these reflex areas, is thought to correspond to a map of
the whole body by stimulating the normal functions of glands, organs as well as parts of the body and finally will encourage the body healing process\textsuperscript{11, 12}.

**Origins of Reflexology:** Reflexology is an ancient techniques of pressure have been practiced for thousands of years by many different cultures in the different part of the world including China, Egypt, and India\textsuperscript{13}. It widely through, although never proven, that the concepts of reflexology have its origins in China roughly 5,000 years ago based on the system of Chinese medicine\textsuperscript{14}. Some people believe that reflexology was developed in Egypt as early as 2330 BC and it believed to be used for more than 4,500 years based on the pictograph evidence that was found in the tomb of Ankomohor, an Egyptian physician in Saquara, Egypt\textsuperscript{7}.

The modern concept of reflexology was introduced to the United States in 1913 by Dr. William Fitzgerald who an ear, nose, and throat surgeon\textsuperscript{15}. He discovered the application of pressure to the tops of the fingers and the middle section of each finger could induce an anesthetic effect on the facial area\textsuperscript{17}. The ideas were continues in the early 20\textsuperscript{th} century through the work of individuals such as Dr. Joseph Riley, a physician, physiotherapist Eunice Ingham, and others, who added their own ideas to the simple ten zone concept\textsuperscript{16}. Applying zone therapy’s basic principles to the feet, they added four lateral lines and further detail to create a map on the feet showing which pressure points correspond to different parts of body\textsuperscript{10}.

**Reflexology Method:** Two methods of reflexology that have been accepted internationally are Ingham method and Rwo Shur method\textsuperscript{17}. The Rwo Shur method was developed in Taiwan by Father Joseph Eugster, a Swiss missionary\textsuperscript{19}. Father Josef’s method was popular amongst the Asian countries and successfully taught in more than 40 regions including Taiwan, China, Japan, Korea, Singapore, Hong Kong and Malaysia\textsuperscript{18, 19}. This method can be quite painful to receive as it mainly concentrated to stimulate the body rather than relaxation\textsuperscript{11, 20}.

The Ingham method of reflexology was invented in 1930 by Eunice Ingham is based on the energy zones of the feet and the rest of the body\textsuperscript{21}. Ingham made the claim that the application of reflexology massage to reflex points on the feet increases blood supply to the corresponding mapped organs in the body\textsuperscript{22}. The Ingham method was different with Rwo Shur method where it does not use any tools or reflex stick in its practice\textsuperscript{23}.

**Theories of Reflexology:** There is still obscurity regarding the action mechanism of reflexology therapy, nevertheless it has certainly been shown to have profound physiological and psychology effects\textsuperscript{24}. Many theories have been used to make clear working system on this holistic therapy. Collectively, there are five theories that support the reflexology mechanism which gives impacts to the body health.

Energy mechanisms theory advocating reflexology points are linked to internal organs and structures by energy channels which become blocked in the event of illness and which are re-opened through reflexology\textsuperscript{25}. During physical suffering or discomfort caused by illness or injury, the human body do not function effectively because the body in imbalance state and consequently blocked the vital energy pathways\textsuperscript{26}.

Another theory of reflexology is neuromatrix theory which also known as gate control theory\textsuperscript{27}. Reflexology is believed to reduce intensity of pain by transmitting afferent impulses and closing the neural gates in the dorsal horn of the spinal cord, therefore blocking pain transmission\textsuperscript{25, 28}. Stimulation of the reflex points on the skin sends messages from these cells through nerve pathways to control centers inside the body, which send other messages back to the muscles or internal organs\textsuperscript{29}.

The next theory proposes that reflexology can break up the lactic acid crystal that usually deposited in the feet and therefore allow energy to flow efficiently\textsuperscript{27}. It is thought that lactic acid deposited as microcrystals in the feet are crushed by the application of pressure or massage which thereby allows for the free flow of energy.

Reflexologists work with the concept that the sole of the foot is a map which represents the entire body\textsuperscript{8, 27}. By palpating the foot, it created a relaxing effect which contributes to relieve tension and stress, affecting the autonomic response, which, in turn, affects the endocrine, immune, and neuropeptide systems\textsuperscript{30}. A theory also suggesting that reflexology is simply a method of showing care and concern for patients.

**Reflex Area and Points:** Foot reflexology involves stimulation of the particulars reflex point in the sole of the foot, which believed to be the nerve center of the body\textsuperscript{31}. There are more than 7000 nerve endings are present in each foot called reflexes\textsuperscript{21}. However, in the oldest classic of the theory of Chinese traditional medicine, practitioner was found a total of 600 points comprise the body, with 66 points located in the feet\textsuperscript{12}. Figure 1 illustrates the base of the ankle and toes on the top of the foot with specific reflex points whereas Figure 2 exhibits the sole with specific reflex points.
Emerging Reflexology Issues

Safety of Reflexology Practice: Reflexology should be avoided when it comes to the particular circumstances. Foot reflexology is discouraged in people with foot fractures, unhealed wounds, as well as active gout or osteoarthritis that affects the foot and ankle. Women in early pregnancy specifically during the first trimester or first three months of pregnancy also should not receive reflexology therapy. Stimulation at the particular reflex points might induce the contractions and subsequent causes the premature delivery as well as the risk of miscarriage. Since reflexology improves circulation, the thrombosis and embolism patients should not be exercised with this kind of therapy because it could potentially cause the movement of clot towards the heart or brain.

Quality Control of Reflexology: Conventional medicine is a highly regulated system in which those who practice it are consistent trained and accountable. Patient who use biomedical services have clearly defined courts of appeal if they are dissatisfied or injured. In contrast, the vast of field of complementary and alternative medicine including modality of reflexology is largely unregulated and practiced by practitioner who may be untrained and dangerous. Therapists may display impressive diploma granted by unregulated, unrecognized and unaccredited institutions.

The Potential of Reflexology: Reflexology is a gentle remedy encourages the body work naturally to regenerate its own balance. It can help both physically and emotional of an individual and bring relief a variety of acute and chronic condition. Recent evidence suggests that reflexology is a simple, less expensive and non-invasive method that effective to regulate the autonomic nervous system activities, coordinates physiological responses, alleviates anxiety, and induces relaxation.

Evidence Base of Reflexology: Even though reflexology has been used for a wide variety of conditions, specific medical claims should always support by sound evidence. There are few studies that evaluate the efficacy or effectiveness of reflexology therapy for various condition of health. The effectiveness of reflexology has been clinically reported in to increase sleep quality and as well as the quality of life; reducing fatigue and anxiety; relieving pain; reducing menopausal symptom and idiopathic constipation; as well as reduced stress.

Conclusion

Reflexology is being embraced in many countries of the world for its provision of enhanced health, mental and physical relaxation coupled with its inherent simplicity and harmlessness. Recently, more scientific and clinical research has been conducted because of its positive effects in reducing and alleviating symptoms,
especially those associated with chronic conditions such as diabetes mellitus, hypertension and muscular illness.

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Ethical Clearance: This study has been approved by the ethics committee of the University of Malaysia Kelantan.

Conflict of Interest: The authors have no conflicts of interest to declare.

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Risk Factors Associated with HIV Infection among General Population in *Tanah Papua*: Secondary Data Analysis of IBBS in *Tanah Papua*, Indonesia 2013

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ABSTRACT

HIV prevalence in adult general population in *Tanah Papua*, has exceeded 1%. Unlike in other regions of the country, that status of the HIV epidemic has entered an early phase of generalized epidemic. The aim of this cross-sectional study as part of National IBBS in *Tanah Papua* in 2013 was to determine the most important risk factors associated with HIV infection among general population in *Tanah Papua* in year 2013. The respondents were 5,334 people aged 15-49 years old who were willing to blood rapid test to determine the HIV status and successfully interviewed. The result showed the HIV prevalence in general population in *Tanah Papua* was 2.3% (95%CI:1.5%-3.4%). There were four determinants significantly associated with HIV infection among the general population: topography, ethnicity, access to VCT services, and cost of VCT services. Particularly for males: topography, ethnicity, status of polygamy, circumcision, access to VCT services were also significantly associated with HIV infection.

**Keywords:** HIV infection, generalized epidemic, general population, Tanah Papua, HIV risk.

Introduction

UNAIDS estimated that South Asia and Southeast Asia are the regions with the second highest mortality rate of HIV related disease after sub-Saharan Africa¹. Indonesia is one of seven countries with the highest HIV infection rate in the Asia². The cumulative number of HIV infections and AIDS in Indonesia until March 2018 are 291,129 cases and 106,965 cases, respectively. Papua is one of five provinces having the highest number of HIV cases in Indonesia with 29,710 cases³. The HIV epidemic in *Tanah Papua*, a region consisting of Papua province and West Papua province, have been showing fastest development from other regions in Indonesia. The status of HIV epidemic in all other regions of Indonesia are still in concentrated level, while the status in the *Tanah Papua* has been considered to enter more advanced phase, which shows the highest level of the HIV prevalence rate among general population (2.4%)⁴.

Sexual intercourse has still been the major mode of transmission of HIV infection around world, including Indonesia. Previous survey conducted in four districts in *Tanah Papua* found that several sexual behaviour among general population were suspected to be important factors associated with HIV infection, such as committing first sex at the age of less than 20 years, having many sexual partners, high sexual activity with more than 10 different partners, sequential sex transaction “in a row” or known as ‘queuing sex’, i.e. one female sex worker serves many men sequentially in a queue, had extra marital sex, and had anal sex⁵. Furthermore, a descriptive study showed more than 90% of the HIV epidemic in Papua was transmitted through sexual pathway⁶.

Despite the high possibility that HIV epidemic in *Tanah Papua*, had entered the advanced state of epidemic and extended its spread to the general population, as indicated strongly by the HIV prevalence rate exceeding 1% among general population⁷, only few studies had been conducted to identify and elaborate the potential and most significant determinants or predictors of the HIV infection among general population in this region. Understanding the real situation and specific
characteristics of this generalized epidemic status, such as its unique HIV distribution patterns and risk factors, would help the central and local governments to implement stronger and more specific strategies, policies and programs to monitor and control the more advanced epidemic in this region. The objectives of this study were to estimate the HIV prevalence rate among general population in Tanah Papua and to know the most important determinants or risk factors associated with HIV infection among general population in Tanah Papua using the IBBS (Integrated Biological and Behavioural Surveillance) data in 2013.

Method

Study Design and Sampling Methods: This study was conducted by analysing secondary data from the National IBBS in Tanah Papua 2013. In this cross-sectional survey a multistage cluster sampling technique was done in several steps with the detail explanation about the study design, sampling and primary analysis can be found in official published report of IBBS survey in general population of Tanah Papua 2013.

Study Population and Sample Size: The study population in this study were all subjects, men and women aged 15-49 years who participated in IBBS survey selected randomly from 12 districts/cities in Tanah Papua year 2013. Totally there were 5,861 interviewed respondents. However, the number of respondents following both interview and HIV rapid blood testing were only 5,334 people.

Data Collection: The main outcome in this study was the HIV status of respondents. HIV positive individual in this study is defined as a person showing positive result in two consecutive serologic tests from their blood sample. In addition, another biologic variable collected in this study was the Syphilis status which was confirmed also through Syphilis blood serologic test.

The IBBS 2013 in Tanah Papua also collected data of sociodemographic, knowledge, behavioural and health services factors. These non-biologic determinants in this national survey were collected through guided interview using standardized piloted structured questionnaires. All the data of National IBBS surveys were officially documented confidentiality by the Ministry of Health, Republic of Indonesia.

Data Analysis

Data was analysed using statistical software, covering descriptive estimates and inferential statistical tests, such as chi-square test in bivariate analysis and logistic regression in multivariate analysis. In this study we employed steps of multiple logistic regression modelling, not only among all general population but also among male population only, in Tanah Papua, 2013. The modelling of this regression had taken into account the weighting strategy of frequency distribution, due to complex sampling design in the IBBS survey. Backward strategy of screening and eliminating variables with insignificant contribution to the model, i.e. those with p-value of Wald Statistics >0.05, would finally result in final regression model with variables only showing significant associations with HIV (p-value <0.05). The strength of associations between the determinants and the HIV status were measured using prevalence odds ratio (POR) and adjusted prevalence odds ratio (a-POR). Role of chance and the precision of association were assessed using the 95% confidence interval of a-POR and the corresponding p-value.

Ethical Considerations: The National IBBS survey had passed the ethical clearance in the Ministry of Health. We also had received official permission from Ministry of Health to use the data of IBBS in Papua year 2013 for this study.

Results

Of 5,861 respondents, 5,334 completed HIV rapid serologic test, and among those completed the test, 120 respondents (2.3%) were identified as HIV-positive individuals. Among 5,328 respondents who completed blood examination for syphilis test, 238 individuals (4.5%) were found positive. Most of respondents were adult people, aged >24 year (64.2%), female (50.8%), married (69.6%), from ethnic of Papuan (76.3%), graduated from primary school (69.5%), living in lowland areas (58.2%).(Table.1)
Table 1: Frequency distribution of the biologic and sociodemographic characteristics of study participants among general population in Tanah Papua, 2013

<table>
<thead>
<tr>
<th>Biologic Characteristics</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HIV status (n = 5,334)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>120</td>
<td>2.3</td>
</tr>
<tr>
<td>Negative</td>
<td>5,214</td>
<td>95.5</td>
</tr>
<tr>
<td><strong>Syphilis status (n = 5,328)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>238</td>
<td>4.5</td>
</tr>
<tr>
<td>Negative</td>
<td>5,090</td>
<td>95.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Socio-demography characteristics</th>
<th>Frequency (n = 5,861)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-24 (adolescent)</td>
<td>1,905</td>
<td>35.5</td>
</tr>
<tr>
<td>&gt; 24 (adult)</td>
<td>3,926</td>
<td>63.7</td>
</tr>
<tr>
<td>Unknown</td>
<td>30</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>3,012</td>
<td>50.8</td>
</tr>
<tr>
<td>Male</td>
<td>2,849</td>
<td>49.2</td>
</tr>
<tr>
<td><strong>Educational level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>3,970</td>
<td>69.1</td>
</tr>
<tr>
<td>Secondary school (≥ Senior High School)</td>
<td>1,859</td>
<td>30.4</td>
</tr>
<tr>
<td>Unknown</td>
<td>32</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>1,621</td>
<td>29.5</td>
</tr>
<tr>
<td>Divorced</td>
<td>62</td>
<td>0.9</td>
</tr>
<tr>
<td>Married</td>
<td>4,149</td>
<td>69.3</td>
</tr>
<tr>
<td>Unknown</td>
<td>29</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papuan</td>
<td>4,128</td>
<td>75.9</td>
</tr>
<tr>
<td>Mixed ethnic</td>
<td>122</td>
<td>2.0</td>
</tr>
<tr>
<td>Non-Papuan</td>
<td>1,584</td>
<td>21.7</td>
</tr>
<tr>
<td>Unknown</td>
<td>27</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Topographic area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highland</td>
<td>2,450</td>
<td>41.8</td>
</tr>
<tr>
<td>Less reachable lowlands</td>
<td>996</td>
<td>17.0</td>
</tr>
<tr>
<td>Easily reachable lowlands</td>
<td>2,415</td>
<td>41.2</td>
</tr>
</tbody>
</table>

Of the respondents, 91.1% had poor essential HIV knowledge; 87.1% had difficulty obtaining condoms; 97.3% had difficult access to VCT service; 96.7% could not afford the cost of VCT service; 70.4% of those had sexual contacts, did not use condom consistently. Among male respondents, 81.5% (2,321/2,849) were uncircumcised. Although relatively small in percentages, respondents also reported some important sexual risk behaviors, such as first sexual contact in young age before 15 years (3.3%), practice of polygamy (4.8%), extramarital sex (11%), anal sex (1.2%), queuing sex (0.6%), sex during menstruation (4.5%), multiple (more than one) sexual partner (11.9%). There were also small percentages of other risk behaviors related to potential HIV blood transmission, i.e. injecting drug use (0.5%), slashing body skin for traditional treatment (3.2%).

Table 2: Frequency distribution of risk factors of knowledge and behavioral and access to health facility among general population in Tanah Papua, 2013

<table>
<thead>
<tr>
<th>Knowledge, behavioral and access to health facility</th>
<th>Frequency (n = 5,861)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HIV knowledge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>5,337</td>
<td>91.1</td>
</tr>
<tr>
<td>Good</td>
<td>524</td>
<td>8.9</td>
</tr>
<tr>
<td><strong>Age at first sex (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 15</td>
<td>171</td>
<td>2.3</td>
</tr>
<tr>
<td>15 - 24</td>
<td>2,660</td>
<td>41.4</td>
</tr>
<tr>
<td>&gt; 25 or never sex</td>
<td>1,703</td>
<td>27.4</td>
</tr>
<tr>
<td>Not remember</td>
<td>1,327</td>
<td>28.9</td>
</tr>
<tr>
<td><strong>Status of Polygamy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>282</td>
<td>4.8</td>
</tr>
<tr>
<td>No</td>
<td>5,579</td>
<td>95.2</td>
</tr>
<tr>
<td><strong>Circumcision (male pop = 2,849)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2,321</td>
<td>81.5</td>
</tr>
<tr>
<td>Yes</td>
<td>527</td>
<td>18.5</td>
</tr>
<tr>
<td><strong>Condom use during sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not consistent</td>
<td>4,126</td>
<td>70.4</td>
</tr>
<tr>
<td>Consistent</td>
<td>6</td>
<td>0.1</td>
</tr>
<tr>
<td>Never had sex</td>
<td>1,729</td>
<td>29.5</td>
</tr>
<tr>
<td><strong>Anal sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>68</td>
<td>1.2</td>
</tr>
<tr>
<td>No</td>
<td>5,793</td>
<td>98.8</td>
</tr>
<tr>
<td><strong>Extra marital sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>645</td>
<td>11.0</td>
</tr>
<tr>
<td>No</td>
<td>5,216</td>
<td>89.0</td>
</tr>
<tr>
<td><strong>Queuing</strong> sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>32</td>
<td>0.6</td>
</tr>
<tr>
<td>No</td>
<td>5,829</td>
<td>99.4</td>
</tr>
<tr>
<td><strong>Sex during menstruation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>262</td>
<td>4.5</td>
</tr>
<tr>
<td>No</td>
<td>5,599</td>
<td>95.5</td>
</tr>
</tbody>
</table>
In the final model of logistic regression modelling for all male and female respondents, we found four statistically significant determinants of HIV infection. As compared to living in less reachable lowland, all respondents living in easily reachable lowland or in highland were significantly about 4 times more likely to get HIV infection (for easily reachable lowland a-POR=3.5; 95%CI:1.3-9.1, while for highland: a-POR=3.9; 95%CI:1.4-10.3). Papuan respondents were about 8 times more likely to be infected by HIV as compared to non-Papuan (a-POR=7.5; 95%CI:3.6-15.8). The significant likelihood to get HIV infection among all respondents that could not afford cost of VCT service was about 9 times than the likelihood among those could afford the cost (a-POR=8.5; 95%CI:3.9-18.5).(Table.3)

Table 3. Significant determinants of HIV infection among all respondents of general population in Tanah Papua, 2013

<table>
<thead>
<tr>
<th>Determinants</th>
<th>Adjusted POr*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a-POR (95% CI)</td>
</tr>
<tr>
<td>1. Topography area</td>
<td></td>
</tr>
<tr>
<td>easily reachable lowland (vs. less reachable lowland)</td>
<td>3.91 (1.47-10.43)</td>
</tr>
<tr>
<td>highland (vs. less reachable lowland)</td>
<td>3.85 (1.44-10.27)</td>
</tr>
<tr>
<td>2. Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Papuan (vs. non Papuan)</td>
<td>7.52 (3.57-15.82)</td>
</tr>
<tr>
<td>-Mixed Ethnic (vs. non Papuan)</td>
<td>0.08 (0.01-0.74)</td>
</tr>
<tr>
<td>3. Access to VCT services (difficult vs. easy)</td>
<td>0.03 (0.01-0.18)</td>
</tr>
<tr>
<td>4. Cost of VCT services (not affordable vs. affordable)</td>
<td>8.46 (3.88-18.45)</td>
</tr>
</tbody>
</table>

*Final model using complex sample multiple logistic regression modelling

Particularly for only male respondents we found five statistically significant determinants of HIV infection in the final model. The likelihood to get HIV infection among male respondents living in easily reachable lowland was significantly about 4 times (a-POR=3.5; 95%CI:1.3-9.1), while among those living in highland was about 3 times (a-POR=2.9; 95%CI:1.3-6.5) than those living in less reachable lowland. Papuan male respondents were about 7 times more likely to be infected by HIV as compared to non-Papuan male (a-POR=6.6; 95%CI:1.9-23.3). The likelihood to get HIV infection among male respondents not circumcised was about 8 times than the likelihood among those circumcised (a-POR=7.8; 95%CI:2.0-29.4),(Table.4)
Table 4: Significant determinants for HIV infection only among male respondents of general population in Tanah Papua, 2013

<table>
<thead>
<tr>
<th>Determinants</th>
<th>Adjusted POR*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a-POR (95% CI)</td>
</tr>
<tr>
<td>1. Topography area</td>
<td></td>
</tr>
<tr>
<td>easily reachable lowland (vs. less reachable lowland)</td>
<td>3.48 (1.33-9.08)</td>
</tr>
<tr>
<td>highland (vs. less reachable lowland)</td>
<td>2.92 (1.30-6.52)</td>
</tr>
<tr>
<td>2. Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Papuan (vs. non Papuan)</td>
<td>6.62 (1.88-23.26)</td>
</tr>
<tr>
<td>Mixed Ethnic (vs. non Papuan)</td>
<td>3.95 (0.84-18.69)</td>
</tr>
<tr>
<td>3. Status of Polygamy (yes vs. no)</td>
<td>0.07 (0.01-0.98)</td>
</tr>
<tr>
<td>4. Circumcision (no vs. yes)</td>
<td>7.75 (2.04-29.43)</td>
</tr>
<tr>
<td>5. Access to VCT services (difficult vs. easy)</td>
<td>0.15 (0.02-0.97)</td>
</tr>
</tbody>
</table>

*Final model using complex sample multiple logistic regression modelling

Discussion

In this study we found that the prevalence rate of HIV among general population in Tanah Papua was 2.3% (95%CI:1.5-3.4); males 2.2%; females 2.3%. The majority of respondents reported poor knowledge about HIV; difficulty obtaining condoms; difficulty of access to VCT; inability to pay the cost of VCT; inconsistent condom use. Among male respondents, the majority were not circumcised. There were four risk factors significantly associated with the increase risk of HIV infection among the general population; topography, ethnicity, access to VCT, and cost of VCT. Among males five risk factors were significantly associated with the increase risk of HIV infection; topography, ethnicity, status of polygamy, circumcision, access to VCT.

The level of prevalence rate in this study was about the same with the previous estimate (2.4%) from the National IBBS survey in 2006, meaning that the epidemic spread in this region was not yet declining since 2006. It is also important to understand that since 2006 the prevalence rate of HIV among general population in Tanah Papua has continued to exceed above 1%, indicating that the epidemic has moved from the concentrated high risk sub-population to the general population7,9.

Concerning ethnicity, we found that HIV prevalence among Papua-native respondents was 2.9%, while among the non-ethnic Papuan and the mixed ethnic (one of the parents was from the ethnic Papuan) were 0.4% and 0%, respectively. This might suggest that the spread or rates of the infection was more intense in the indigenous people. We could say that the Papuan ethnic were significantly at higher risk 6.6 times (for all general population) or 7.5 times (for male general population) to get infected by HIV, as compared to the non-Papuan. Another important demographic characteristic was related to topographic of residency. Our study showed that people living in highland or easily reachable lowland were significantly at higher risk 3 to 4 times to get HIV infection than those living in less reachable lowland. We also noticed that in highland, there were much higher proportion of Papuan inhabitants (34.1%) as compared to the non-Papuan (0.4%). If the increasing risk of HIV infection attributed to ethnicity were true, some may speculate that there could be some local specific characteristics of the Papuan people leading to more vulnerable situation to be infected. Regarding the sexual risk behaviour among Papuan and its socio-cultural context, Knautf noted that unauthorized relations in the form of heterosexual intercourse before marriage or heterosexual ceremony acceptance were evident in all Papuan cultural regions10. However, we believe that comparison of HIV prevalence rates based on ethnicity does not reflect that there are differences in risk based on ethnic factors alone, but rather reflects the different levels of knowledge about hazards and prevention of risky behavior4,5. With respect to knowledge and risk behaviour as more important factors than the ethnic itself, our study had shown that there were slightly higher proportions of Papuan respondents with poor knowledge (92%vs.85%) and with multiple sex partners (34%vs.31%), as compared to the non-Papuan.
Concerning biological risk factors, as compared to non-Papuan respondents, there were higher percentages of Papuan respondents with positive Syphilis status (5% vs. 0.5%). In addition, percentage of uncircumcised Papuan males were much higher than the non-Papuan (99% vs. 22%). From the perspective of HIV transmission, we had paid more attention to this high percentages of uncircumcised males. Our study showed that the uncircumcised males would have higher significant probability to get infected by HIV than the circumcised males. Consistence with our finding, we found more evident from several other studies suggesting that circumcision might play important biological role in preventing the HIV infection, like researches in Brazil (OR=0.3)\textsuperscript{11}, South Africa (w-PRR=0.52)\textsuperscript{12}, and Uganda (a-OR=0.65)\textsuperscript{13}. Nevertheless, we also found other finding from Mutombo et.al in Malawi stating that there was not any significant different in getting risk of HIV infection between the circumcised and the uncircumcised people\textsuperscript{14}. Meta-analysis study covering many studies in sub-Saharan African countries\textsuperscript{15} and other systematic reviews from Wilson et.al\textsuperscript{16}, Weiss et.al\textsuperscript{17}, and Valley A, et.al\textsuperscript{18} generally conclude that medical male circumcision was quite effective to prevent HIV infection.

Main limitation was that statistical associations in this cross-sectional study may not be interpreted as causal relationships. Since risk behaviours related to HIV transmission were quite sensitive to ask among general population respondents may not fully honest answering the sensitive questions then underreporting of data can possibly occur.

Conclusions

We conclude: 1) the HIV prevalence in general population in Tanah Papua was 2.3% (95%CI:1.5%-3.4%); 2) Significant determinants associated with HIV infection among general population were topography, ethnicity, access to VCT and cost of VCT. Particularly for male population, topography, ethnicity, access to VCT, status of polygamy and circumcision were also significantly associated with HIV infection.

Unlike in other regions in the country, the HIV epidemic in Tanah Papua has entered advanced state and extended to general population. Therefore, the HIV Surveillance system in this region should also be extended and strengthened to monitor not only trends among specific high-risk key populations but also among the general population, as a whole. Sentinel surveillance HIV towards specific populations (as proxy of general population) such as pregnant women attending ANC clinics and pulmonary TB patients should be strengthened. Rapid behaviour survey to monitor trends and changes of sexual behaviour risk factors among general population could be implemented on regular basis. Specific behaviour change interventions should be implemented such as promoting, encouraging and targeting young male population to accept and undergo medical male circumcision. In order not to confuse with traditional religious circumcision which confusion may lead to rejection, local religious leaders should be invited and involved to clarify that the medical circumcision (with its’ own scientific technique) as a preventive measure of HIV, has nothing to do with particular religion’s obligation or rituals. Improving access and maintaining low cost of the already available VCT program are necessary. Specific qualitative study to learn about psycho-socio-cultural dimensions of Papuan people could be proposed as the foundation for designing more specific and appropriate behaviour modification intervention programs.

Acknowledgements

The authors would like to thank the Sub Directorate of HIV/AIDS and IMS, Ministry of Health, Republic of Indonesia for borrowing the data set. The publication of this article was supported by LPDP, Ministry of Finance, Indonesia and Universitas Indonesia through a HIBAH PITTA grant.

Conflict of Interest: The authors declared that no competing interest.

REFERENCES


Vitamin D Status in Umbilical Cord Blood Related to Neonatal Birth Weight

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1Faculty of Public Health, Indonesia University, Depok, West Java, Indonesia

ABSTRACT

Introduction: Birth weight is an important determinant of infant’s survival and future development. Insufficient supply of vitamin D during fetal growth can affect birth outcomes.

Objective: This study aimed to analyze relation of vitamin D status with neonatal birth weight.

Method: This study used a cross-sectional design on 144 pregnant women and their infants that met inclusion criteria. Umbilical cord blood 25-hydroxyvitamin D [25(OH)D] was examined by Electro Chemiluminescence Immuno Assay method. Analysis used multiple linear regression.

Results: The mean concentration of 25(OH)D was 27.6 ng/mL and only 37.5% neonates had adequate vitamin D. The average birth weight was 3090.6 gr. After being controlled by maternal weight gain during pregnancy and energy intake, the mean birth weight was significantly 166.5 gr smaller in neonates with vitamin D deficiency (p<0.05).

Conclusion: Vitamin D status is related to neonatal birth weight. Efforts to increase vitamin D intake in pregnant women are necessary to improve fetal vitamin D status followed by exposure to sunlight.

Keywords: Birth weight, neonatal, vitamin D

Introduction

Birth weight is an important indicator for assessing the infant survival. Low birth weight (LBW) in Indonesia is still a problem because 11.2% have an impact on prenatal death (4). LBW is a significant predictor of prenatal mortality and morbidity. Barker’s theory explains that LBW also increases the risk of poor cognitive development and non-communicable diseases in the future, such as diabetes and cardiovascular disease2,3).

Based on the 2013 National Basic Health Research, the LBW prevalence at 10.2%, Bengkulu Province at 9.7%, the highest in Sumatra (1). In Asian countries, LBW is mostly associated with intrauterine growth retardation (4). Maternal malnutrition is the main factor contributing to poor pregnancy outcomes (5).

Vitamin D 25(OH)D is one of the essential minerals that have various functions of the body’s physiological processes. Primary functions was to maintain calcium levels in a healthy physiological range to support multiple metabolic functions, regulation of bone transcription, and metabolism (6). Another role is to modify the immune system and regulate cell proliferation and differentiation (7). An adequate vitamin D concentration during pregnancy is needed for growth and mineralization of the developing fetal bone (6). Vitamin D deficiency in pregnant women results in neonatal insufficiency (8) and is often associated with adverse birth outcomes (9).

The study on vitamin D in Indonesia is very limited. Study on the first-trimester pregnant women in Jakarta shows the vitamin D deficiency by around 90% (10). Studies examining correlation of vitamin D with neonatal birth weight have never been carried out. Therefore, this study aimed to assess relationship of vitamin D serum with birth weight.
Materials and Method

This study used a cross-sectional design conducted in Bengkulu, Indonesia. Samples of the study were 144 pregnant women and neonates’ mothers who met the criteria, including single pregnancy, gestational age ≥ 32 weeks, infants born at term. The exclusion criteria were mothers suffering from chronic diseases, namely diabetes, hypertension, parathyroid disorders, liver, heart or kidney disease; infectious diseases (tuberculosis, malaria, HIV-AIDS); taking medicines that affect vitamin D metabolism (including glucocorticoids and anti-seizures), neonatal births with congenital malformations.

Data collection on maternal characteristics include age, education level, occupation, family income, and obstetric history through interviews. Addition of maternal weight during pregnancy is known by comparing differences in body weight at the end of the third trimester with pre-pregnancy weight written in the “maternal and child health book”. Maternal nutritional intake macronutrients (energy, protein and fat) were obtained using 2x24 hour recall technique.

Serum vitamin D samples are taken from cord blood on the placental side of the mother. Blood samples were centrifuged at 1500 rpm for 15 minutes and stored in a freezer at -20 °C, for further analysis using the Electro Chemiluminescence Immuno Assay (ECLIA). Analysis was carried out at “Kimia Farma Laboratory” that is accredited and has ISO 9001:2015. The reference values used by the laboratory are also values recommended by the Clinical Guidelines Subcommittee of the Endocrine Society. Vitamin D deficiency if 25(OH)D ≤ 20 ng/mL, insufficiency if 25(OH)D 21-29 ng/mL and sufficiency if 25(OH)D ≥ 30 ng/mL (11). Specifically, the cutoff vitamin D in neonates is absent (12). Calcium examination was measured by a photometer using the Ion Selective Electrode (ISE) method. The birth weight of infants was measured during the first hour of birth with the Seca brand portable scales (type 231/231 Corp Hamburg, Germany) with an accuracy of 0.01 gr.

Analysis of two mean independent tests (independent t-test) was applied to determine differences in vitamin D serum with average birth weight. The multivariate analysis used multiple linear regression. Significant if p value < 0.05.

Findings

Based on maternal characteristics, the average age was 27.8 years. They were mostly senior high school graduates (41.7%) and housewives (81%). The average family income was IDR 2,307,638. The average weight gain was 12.7 kg, the average nutritional intake per day, energy of 1682.1 kcal, protein of 59.5 gr, fat of 53.2 gr.

The average birth weight was 3090.6 gr. The average concentration of vitamin D 25(OH)D was 27.6 ± 9.5 ng/mL and concentration of calcium was 10.1 ± 1.8 mg/dL (table 1).

Table 1: Characteristics of neonatal

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD</th>
<th>Min-Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight (gr)</td>
<td>3090.6 ± 397.2</td>
<td>2200-4200</td>
</tr>
<tr>
<td>Vitamin D [25(OH)D]</td>
<td>27.6 ± 9.5</td>
<td>6.5 - 49.2</td>
</tr>
<tr>
<td>Calcium serum (mg/dL)</td>
<td>10.1 ± 1.8</td>
<td>5.5 - 14.5</td>
</tr>
</tbody>
</table>

In bivariate analysis, vitamin D status was divided into 2 groups, deficiency of 25(OH)D (< 30 ng/mL) and sufficiency of 25(OH)D (≥ 30 ng/mL). The average birth weight differed significantly between vitamin D deficiency and sufficiency (table 2).

Table 2: The mean of birth weight neonates based on vitamin D

<table>
<thead>
<tr>
<th>Vitamin D Status</th>
<th>Birth weight</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>n</td>
</tr>
<tr>
<td>Deficiency (&lt; 30 ng/mL)</td>
<td>3018.5 ± 372.7</td>
<td>90</td>
</tr>
<tr>
<td>Sufficiency (≥ 30 ng/mL)</td>
<td>3211.4 ± 410.2</td>
<td>54</td>
</tr>
</tbody>
</table>

*p = < 0.05

Concentration of calcium, maternal weight gain during pregnancy and energy intake were correlated with neonatal birth weight (p-value < 0.05) (table 3).

Table 3: Correlation maternal characteristics to birth weight

<table>
<thead>
<tr>
<th>Variable</th>
<th>P value</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>&lt;0.001*</td>
<td>0.327</td>
</tr>
<tr>
<td>Maternal age</td>
<td>0.135</td>
<td>0.125</td>
</tr>
<tr>
<td>Maternal weight gain</td>
<td>0.023*</td>
<td>0.190</td>
</tr>
<tr>
<td>Energy intake</td>
<td>&lt;0.001*</td>
<td>0.317</td>
</tr>
<tr>
<td>Protein intake</td>
<td>0.254</td>
<td>0.096</td>
</tr>
<tr>
<td>Fat intake</td>
<td>0.218</td>
<td>0.103</td>
</tr>
</tbody>
</table>

*p = < 0.05
In multivariate analysis, the regression model showed that, after being controlled for maternal weight gain and maternal energy intake, the average birth weight was significantly 166.5 gr smaller in neonates with vitamin D deficiency, p value = 0.008 (table 4).

**Table 4:** Regression linier model of birth weight

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>p</th>
<th>95.0% CI for β Lower bound</th>
<th>Upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin D deficiency</td>
<td>-166.5</td>
<td>0.008</td>
<td>-44.1</td>
<td>-288.9</td>
</tr>
<tr>
<td>Maternal weight gain</td>
<td>43.8</td>
<td>&lt;0.001</td>
<td>21.2</td>
<td>66.4</td>
</tr>
<tr>
<td>Energy intake</td>
<td>0.35</td>
<td>0.001</td>
<td>0.1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Discussion**

The results of this study noted the average 25(OH)D was 27.6 ng/mL. By using the cut off the US Endocrine Society, the recommended vitamin D concentration $\geq$ 30 ng/mL. The study indicated the deficiency 62.5% (deficiency at 25.7% and insufficiency at 36.8%). Not much different from the Hawaii by 68% (deficiency at 19% and insufficiency at 49%) (13). In India, deficiency is much higher at 83% (deficiency 63% and insufficiency 20%) (14). If comparing the average of vitamin D in three countries, there is almost no significant difference.

Umbilical cord vitamin D status describes maternal vitamin D status (15-17) because maternal vitamin D is the only source of fetal vitamin D that easily enters the fetus through the placenta (18). Therefore, low maternal vitamin D levels have implications for low fetal vitamin D status. Although the Bengkulu City is a tropical region located at 30045'-30059 `South Latitude - 102014'-102022' East Longitude in which the sun shines throughout the year, only a small portion of mothers (37.5%) have a sufficient level of vitamin D. This study supports a previous research through a systematic review that vitamin D deficiency is common and has become an epidemic of public health problems around the world, especially women and children (19,20), including in countries with sun-rich exposures throughout the year such as the Middle East (16).

Low concentrations of vitamin D can be affected by limited exposure to sunlight as the primary source of vitamin D and and food intake of source of vitamin D (21). In this study, the factors that might cause vitamin D deficiency was not examined. However, the phenomenon of female in Bengkulu showing a tendency to avoid themselves from the sun exposure, using sunscreen to make the skin white and wearing clothes that cover almost full body when going outside home can limit vitamin D synthesis through the maternal skin. For further studies, these factors need to be considered.

This study proves a significant association between vitamin D status and birth weight. The average birth weight was 166.5 gr in neonats with vitamin D status $< 30$ng/ml compared vitamin D status $\geq$ 30 ng/mL. These results can be attributed to the important role of vitamin D status in determining the transfer of vitamin D and calcium from the mother to the fetus through the placenta. An adequate amount of vitamin D increases the transfer efficiency and calcium absorption to the fetus. Without vitamin D, only 10% to 15% of the diet calcium can be absorbed. In women on which 25-hydroxyvitamin D levels increases from an average of 20 to 32 ng/mL, the interaction of 1,25-dihydroxy vitamin D (an active form of vitamin D) with vitamin D receptor (VDR) increases the efficiency of calcium transport to the intestine by 45 up to 65% and absorption of calcium 30 to 40% (6). By these data, 25-hydroxyvitamin D levels from 21 to 29 ng/mL (52-72 nmol/L) can be considered to indicate relative deficiencies of vitamin D, and levels of 30 ng/mL or higher indicate the recommended vitamin D limit(11).

Growing evidence suggests that vitamin D deficiency during pregnancy can interfere with fetal growth and adverse pregnancy outcomes. This evidence shows the same results with this study. Studies in South India showed a significant difference in the average birth weight of infants based on the concentration of vitamin D in cord blood. The lower levels of vitamin D, the lower the average birth weight of the infant (14). Studies in Iran proved a significant relationship of vitamin D deficiency in pregnant women with LBW (22). Several studies in China found that both mother and neonate at Beijing had normal levels of 25(OH)D ($> 30$ ng/mL) and severe vitamin D deficiency in mothers and neonates had a higher risk of LBW with an average baby weight birth 3354.8 gr at birth was among neonates with < 25 nmol/L and 3640 gr among neonates with vitamin D $\geq$ 25 nmol (15). Maternal vitamin D status was positively associated with infant birth weight, after adjusting for confounders, birth weight increased by 69 gr/mL by an increase of 25(OH)D less than 20 ng/mL (23). Maternal vitamin D deficiency significantly increases the risk of neonatal low birth weight by 2.8 times(17).
The case is slightly different from the results of a study in Anhui, China, which showed an inverse U-shape relationship between birth weight on cord D vitamin status. There was an increase in birth weight of 61 gr at a concentration of < 40 nmol/L, but decreased by 68.5 gr at a concentration of 40-70 nmol/L. (24) Even though the results are diverse, but many other shreds of evidence support the positive relationship of vitamin D and birth weight. Results of Randomized Clinical Trial (RCT), by providing vitamin D supplementation to pregnant women (gestational age of 24-26 weeks) with deficient and insufficient vitamin D < 30 ng/mL of 25(OH)D, showed that vitamin D supplements increased maternal blood vitamin D levels and fetal growth such as length of body weight and neonatal head circumference (25). A meta-analysis conducted on 13 RCTs also showed the benefits of vitamin D supplementation during pregnancy which increased circulating levels of 25(OH)D during labor by 66.5 nmol/L, body weight by 107.6 gr and birth length by 0.3 cm (26). These results are strengthened by other meta-analysis reported from three experimental studies (Brooke 1980; Marya 1988 and Sablok 2015) involving 493 pregnant women who received vitamin D supplements during pregnancy that had fewer babies with birth weight below 2500 gr compared with pregnant women who did not receive the intervention (27).

Conclusion

Maternal vitamin D status measured through neonatal umbilical cord is correlated with birth weight. The average of neonatal birth weight is lower on the vitamin D deficiency status. Efforts to increase vitamin D intake in pregnant women to improve fetal vitamin D status, which has implications for neonatal birth weight, need to be made. In addition, it is necessary to be followed by an increased exposure to sunlight.

Conflict of Interest: We declare that we have no conflict of interest.

Source of Funding: No funding source for the research.

Ethical Clearence: The Ethical clearance has been endorsed by the Health Research Ethics Committee Faculty of Public Health, Indonesia University.

REFERENCES


The Effect of the Predicate Exercises to a Rotor in Some Physical Abilities and Skill Performance Hands Jump Forward on the Floor Mat Movements for Students

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ABSTRACT

The gymnastics game is one of the sports in which the level of performance to the point of creativity and innovation where ground movements are the basis for most movements on the rest of the other devices where the learning is related to learning the basic conditions of the primary because they are the basis in learning these movements and mastery in a timely manner. The research community represents the students of the third stage of the Faculty of Physical Education and Sports Sciences/University of Kufa (58) students by the two divisions (B) and (C).

Then the tests were carried out on the sample and the program was applied and then the statistical steps were taken and the results were extracted based on which the conclusions were drawn.

Research Aims:
1. Design and manufacture of an auxiliary device to teach the skill of the jump of the front hands on the ground movement
2. Prepare exercises help on the device of the rotator to teach the jump of the front hands on the floor movements.
3. To recognize the effect of exercises on the help of the rotator to learn the skill of the jump of the front hands on the floor of the movements of the ground.

Research Hypothesis: There is an effect of the exercises on the rotator system in some biochemical variables and learning the skill of the forehand jump on the ground movement mat, and the preference for the benefit of the experimental group in the posttests.

Keywords: Predicate exercises, physical abilities and Hands jump forward.

Introduction

The gymnastics game is one of the sports in which the level of performance to the point of creativity and innovation where ground movements are the basis for most movements on the rest of the other devices where the learning is related to learning the basic conditions of the primary because they are the basis in learning these movements and mastery in a timely manner.

Among the ground movements is the skill of the forehand jump, which is one of the most important skills in the field of the ground movements. This skill requires special physical and motor abilities that differ from the rest of the other skills. The shape of the hand jump is done by rotating the body around it. Explosive ability of the muscles of both legs and arms.

Hence the importance of research in the preparation of exercises help on a device designed to teach the technical performance of the skill of the jump of the front hands on the ground movements of students of the third stage at the University of Kufa.

The effectiveness of gymnastic activities that require a long time to learn their skills because of the difficulty of performing those skills, which require physical qualities and high mobility.¹

Since the researcher is one of the graduates of the Faculty of Physical Education and Sports Science and
one of the people interested in the effectiveness of the gymnastics and through his observation in the field found that it is difficult to learn the skill of the jump on the hands of the front ground movements.

Therefore, the researcher decided to go into this experiment through the design of a teaching assistant and the preparation of exercises help and the goal is to help learners to adjust the motor tracks of the skill and learn faster.²

Research Methodology and Field Procedures:

**Methodology:** The researcher used the experimental method to suit the nature of the problem to be solved in order to achieve the objectives of the research and its hypotheses. He also used the design of the two sets of control and experimental group so that the two groups are completely equal in all their circumstances except the experimental variable that affects the experimental group.

**Community and Sample Search:** The research community represents the students of the third stage of the Faculty of Physical Education and Sports Sciences/University of Kufa (58) students by the two divisions (B) and (C), in order to satisfy the research requirements in them and in light of that the researcher chose the main research sample of (20) divided students (B) the experimental group, and (C) the control group. Thus, the percentage of the sample of the research is (38.46%) of the sample, from the original search community.

**Means, Tools and Devices used in Research:**

**Information Gathering Methods:**
- Arab and foreign sources.
- Personal interviews.
- Questionnaire.
- Observation.
- Camera (video camera) number (2) Type (casio) Japanese-made frequency (120) Image/Sec.
- Drawing scale (1 m).
- Metal measuring tape.
- Simple sponges compressed by measurement.
- Adhesive tapes.
- Medical balance for weight measurement.
- Designer educational system.

**Field Research Procedures:**

**Specify Search Variables:** After reviewing several sources and scientific studies, as well as conducting some personal interviews, and consultation with the supervisor, the physical variables were identified and were presented to the Scientific Committee for approval of the subject, where it was agreed on the most important physical variables were as follows:

1. Explosive power of the muscles of the two legs.
2. The speed of the arms.

**Determination of Measurements and Tests of Variables:** Measurements and tests were determined to measure the search variables, which can be measured and measured in terms of the physical abilities under study, as follows:

**First:** Test the wide jump of stability/measure the explosive power of the two legs (1)

**Tools used:** Mat or flat ground or skirting hole with tape measure.

**Performance description:** The player stands behind the starting line and the distance between his feet width knots or inches and the toes on the line of advancement to prepare to jump, the person swings his arms back and forward next to the knees where he begins to extend the knees and swing the arms forward at the same time, the rules gives the student three attempts measured distance Between the advancing line of the heel or any part of the body touching the ground closer to the line of advancement.

**Registration:** Registration of the best attempt from the three attempts to the nearest (meters).

**Second,** the speed test for the arms, the front leaning, bending the arms continuously for 10 seconds:¹

**Performance Specifications:** The laboratory takes the position of the front-end position on the ground so that the body is upright at the starting signal. The laboratory will bend the arms fully if the performance persists as many repetitions as possible without stopping for ten seconds.

**The conditions:**
- Notes the integrity of the body tested during performance.
- Not allowed to stop during performance.
The need to touch the chest of the earth when performing.

Note the full length of the arms.

Registration: The degree of the laboratory is the number of correct repetitions within a period of (10 seconds).

Design and Manufacture of Rotary Armchair (Educational Equipment): By presenting simple details about the skill of the front-hop and the problem associated with a group of experts and specialists to find the appropriate solutions to facilitate the process of teaching that skill. In consultation with experts, specialists and an engineer, Note Figure (1).

Figure 1: Shows the educational rotor pad

Components of Rotary Armrest Device:

First: The device consists of rotary cylinder length of (110 cm) and diameter (40 cm) This cylinder is coated with compressed sponge and then wrapped with a normal skin completely.

Second, the number of supports (2) to support the cylinder on the ground where it is installed tightly to avoid any movement of the device, through which can control the height of the cylinder up and down in order to fit the average length of the research sample.

Third: The device also contains a rubber band length of (110 cm) and width (20 cm).

Features:

- The device can increase or decrease the height and distance depending on the length and capacity of the player.
- Facilitate the teaching of the technical stages of the skill of the leap of the front hands through the fragmentation of the stages and learn each of them separately.
- Ease of use of the device by any learner without the intervention of any teacher or colleague.
- Is a means of encouragement by learning skills easily and away from the fear and routine to learn traditional skill performance?
- Features of the device can be transferred to any place for easy to carry.
- Is a specialized equipment in the effectiveness of the gymnastics?

Main Experience:

Pre Tests: The researcher conducted the Pretest of the research sample on 22/3/2018 at 9:00 am on Thursday and at the gymnasium hall in the Faculty of Physical Education and Sports Sciences/University of Kufa.

Posttests: The Post tests were carried out on the control and experimental groups for the skill of the forehead jump on the ground movement mat on 6/5/2018 corresponding to Sunday at 10 am in the gymnasium hall of the College of Physical Education and Sports Sciences at the University of Kufa.

Results and Discussions

View the results of the Pre and Posttests of the control group of physical abilities

Table 1: Shows the mean, standard deviations, the calculated value of (t) of the interrelated samples

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Pretest Mean</th>
<th>Pretest SD</th>
<th>Posttest Mean</th>
<th>Posttest SD</th>
<th>(t) value</th>
<th>Test level indication</th>
<th>Type of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosive power</td>
<td>Meter</td>
<td>2.239</td>
<td>0.072</td>
<td>2.834</td>
<td>0.138</td>
<td>5.882</td>
<td>0.000</td>
<td>Sig.</td>
</tr>
<tr>
<td>The power of speed</td>
<td>Number</td>
<td>5.9</td>
<td>1.1</td>
<td>7.1</td>
<td>0.875</td>
<td>6.000</td>
<td>0.000</td>
<td>Sig.</td>
</tr>
</tbody>
</table>
View the results of the Pre and Post testing of the experimental group of physical abilities:

Table 2: Shows the mean, standard deviations, the calculated value of (t) of the interrelated samples

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Pretest Mean</th>
<th>Pretest SD</th>
<th>Posttest Mean</th>
<th>Posttest SD</th>
<th>(t) value</th>
<th>Test level indication</th>
<th>Type of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosive power</td>
<td>Meter</td>
<td>2.231</td>
<td>0.12</td>
<td>2.637</td>
<td>0.1</td>
<td>13.968</td>
<td>0.000</td>
<td>Sig.</td>
</tr>
<tr>
<td>The power of speed</td>
<td>Number</td>
<td>6.2</td>
<td>0.918</td>
<td>8.1</td>
<td>0.737</td>
<td>6.862</td>
<td>0.000</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Discuss the results of the Pre and Posttests of the control and experimental groups of physical abilities: The researcher attributed the reason for the difference in the control group to the methods and repetitions of the educational exercises that were used, and the application by the teacher on the members of the control group, as the repetition exercises give results and improvement of the athlete even if the components of the curriculum is not regularly codified because of the athlete’s physical exertion and adapt to a certain level during the duration of education, as it was standardized on the basis of scientific and commensurate with the method of education for the disposal of energy appropriate for this work, which takes only a few seconds, Mainly in the development of the explosive capacity of the muscles of the two men physical exercises on the device using the body weight and the momentum on the rubber band installed on the device as well as the use of jumping exercises on the ground floor has an impact in the development of this attribute, “exercises that use great resistance is one of the appropriate means to develop the components of explosive power” 4

The results presented in Tables (1) and (2) showed the strength test for the muscles of the hands for the Pre and Posttests. The results of their tests were significant for the post-test of the control and experimental groups. The researcher found that the effectiveness of the exercises used by the teacher in the control group as a result of moral differences, and this means that any physical work performed by the athlete has a positive and noticeable effect, but the difference lies in the size of this effect and the difference from one group to another and from one curriculum to another and this should be emphasized during the development of educational curricula, Especially for the predicate on the rotor and prepared by the researcher for members of the experimental group which is characterized by rapid and appropriate intensity frequencies specified helped to bring the moral difference special force as soon as the muscles in your hands.5

View the results of the technical performance of the skill leap forward hands in the two tests and analysis evaluation:

Table 3: Shows the mean and standard deviations and the value (t) calculated

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre Test Jump the front hands Mean</th>
<th>Pre Test Jump the front hands SD</th>
<th>Post-test Jump the front hands Mean</th>
<th>Post-test Jump the front hands SD</th>
<th>(t) value</th>
<th>Test level indication</th>
<th>Type of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>4.469</td>
<td>0.355</td>
<td>5.580</td>
<td>0.332</td>
<td>14.425</td>
<td>0.000</td>
<td>Sig.</td>
</tr>
<tr>
<td>Control</td>
<td>4.438</td>
<td>0.384</td>
<td>4.970</td>
<td>0.331</td>
<td>3.863</td>
<td>0.004</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Discuss the results of the technical performance assessment of the skill of the forehand jump on the floor mat: The results presented in Table (3) for the values of the computational and standard deviations and the values of (t) calculated in the Post tests of the technical performance of the skill of the front-hand jump on the mat of the movements of the ground revealed significant differences between the Pre and Post tests and in favor of the Post tests in both control and experimental groups, technical performance of the members of the control group is due to repetitions of exercises by the teacher material and performed by students in the educational units and regularity in the process of education, and the repetitions lead to the consolidation of the program “The redundancy of any work will reduce the error rates and increase the learning rates, as well as lead to the rapid retrieval of information from memory, so the learner is given many attempts during the initiation of learning“ 6.
As for the differences shown in table (3) of the experimental group, the researcher attributed him to the exercises that were prepared on the designed device, which focused on what the technical performance of the skill of the leap forward hands, as the exercise focused on controlling the biochemical changes related to skill as well as contribute And greatly in the development of physical qualities and mobility of students and this helps them to perform the skill efficiently, and the development of these qualities contribute effectively to the economy effort and time during educational science.7

View the results of the technical performance of the skill of the hands jump forward assessment of the two sets of research in posttest and analysis:

<table>
<thead>
<tr>
<th>Skill</th>
<th>Post test Exp. group</th>
<th>Post test Cont. group</th>
<th>(t) value</th>
<th>Test level indication</th>
<th>Type of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jump the front hands</td>
<td>5.518 0.332</td>
<td>4.970 0.331</td>
<td>3.693</td>
<td>0.002</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Discuss the results of the Post tests to evaluate the technical performance of the skill of the leap of the hands on the front of the ground movements: By observing the values shown in Table (4), we found that the two groups achieved statistically significant differences in the level of performance evaluation of the front-hand jump. However, the differences were higher for the experimental group of the control group by observing the difference in the values of the computational circles The researcher attributed the reason to the fact that the assessment in the gymnastic depends on the technical performance, so the improvement of the power component will help to correct errors associated with performance and reduce by increasing the factors of control and control of the body to serve the goal of movement and the course of movement during performance “The player who has the power can control the technique”.8 This is true with the experimental research sample, which carried out the special exercises with different repetitions on the designed device, which played a large and effective role in improving the values of the biochemical variables of skill as well as its contribution to the development of two elements Muscle strength and motor speed of the arms and legs and well,9 which led to the strengthening of the possession of the sample to the characteristics of strength and speed and investment in improving the overall level of skill performance.10

Conclusions
1. The exercises on the designed device led to a great learning of the technical performance of the skill of the leap forward hands.
2. The special exercises on the device designed to develop some biochemical changes.
3. There was a slight improvement in some biochemical parameters investigated by the control group.

Ethical Clearance: Taken from University of Kufa, Iraq
Source of Funding: Self
Conflict of Interest: None

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Assessment Sarcopenia, Serum Interleukin-6, Alpha 1-Antichymotrypsin and Other Biomarker in Female Patients with Rheumatoid Arthritis

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¹College of Medicine, Al-Mustansiriyah University

ABSTRACT

Objective: assessment of muscle bulk, sarcopenia, skeletal muscle mass index (SMI), serum interleukin-6 (IL-6), Alpha 1-antichymotrypsin, myoglobin, and C-reactive protein between female patients with RA and healthy control groups.

Method: Eighty eight subjects, fifty eight female patients with RA (age 42.0 ± 6.0 years) and thirty female control (age 41.8 ± 6.1 years) were enrolled in this study. Skeletal muscle mass index (SMI) was measured with dual-energy X-ray absorptiometry (DXA). IL-6 and α1-ACT, myoglobin, and C-reactive protein were measured in serum by using ELISA.

Results: Study showed that SMI in patients with RA were significantly lower than that in the healthy controls, serum Myoglobin level these was no significant difference in RA patients from controls, The serum CRP level in RA patients were significantly higher than that in the healthy controls and the same was also for serum IL-6 level. In addition, Patients with RA showed a significant increased level of serum alpha-1 ACT compared to healthy controls.

Conclusion: the risk of sarcopenia is higher in RA patients in comparison to healthy controls of the same age. SMI was significantly lower in RA patient’s compared to healthy controls. There is no significant changes in serum myoglobin in RA patients compared to healthy controls because myoglobin level changes is closely associated with muscle damage but not muscle mass loss. There is a significant increase in serum CRP, IL-6 and ACT in RA patients compared to healthy control.

Keywords: Rheumatoid arthritis, sarcopenia, SMI, IL-6, ACT, Myoglobin, CRP

Introduction

Rheumatoid arthritis (RA) is one of the most important chronic, systemic, inflammatory disorders that affect the joints and musculoskeletal systems, which is characterized by inflammation of synovial joints in a symmetrical pattern¹. It usually presents with pain, swelling and stiffness of joints in combination with raised levels of inflammatory markers². The inflammatory process can lead to destruction of cartilage and bone, resulting in joint deformities, permanent functional impairment and disability³.

Interleukin-6 is a substance produced in response to injury or trauma of tissue by specialized white blood cells called T-cells, as well as macrophages and endothelial cells³,⁴. After production of IL-6 from macrophage and other cells, carried via the blood stream to the liver rapidly stimulates synthesis of acute phase proteins such as CRP and α1ACT⁵. α1ACT is a serine protease inhibitor which rises in inflammatory conditions and has been implicated in the pathology of a number of devastating human diseases including chronic obstructive pulmonary disease, Parkinson’s disease and Alzheimer’s disease⁶. In RA the serum concentration of ACT was described as a reliable indicator of the mass of inflamed tissue⁷. Myoglobin (Mb) is “a highly soluble monomeric hemoprotein with a low molecular weight (18 KDa)”, that binds dioxygen in cardiac myocytes and oxidative skeletal muscle⁸.

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C-reactive protein (CRP) is an acute-phase serum protein and is a member of the pentraxin protein family, which is released in the circulation in response to inflammation, degenerative, and neoplastic diseases. We aimed to assess muscle bulk and sarcopenia in female patients with Rheumatoid arthritis. And compare the results of skeletal muscle mass index (SMI), serum interleukin-6 (IL-6), Alpha 1-antichymotrypsin, myoglobin, and C-reactive protein between female patients with RA and healthy control groups.

**Method**

**Subjects:** Eighty-eight subjects, fifty-eight female patients with RA (mean age 42.0 ± 6.0; range of age 30-50 years) and thirty female control (mean age 41.8 ± 6.1; range of age 30-50 years) were enrolled in this study.

**Blood Sample:** The sample taken in laboratories of (Al-Yarmouk teaching Hospital) was five milliliters of venous blood was collected from patients as well as Controls and put in a gel tube (without any anticoagulant). Blood in the tubes were allowed to clot for (2 hours) then centrifuged at (1000) round per minute (rpm) for (20 minutes) to get serum. Each subject serum was immediately put into five Eppendorf tubes and stored at (-20°C) freezer until analysis (this method was taken from the kit (Mybiosource,USA)).

**Clinical Diagnostic Measurement:** Measuring the Skeletal Mass Index by Dual Energy X-ray Absorptiometry (DEXA), Appendicular skeletal muscle mass (ASM) was measured with dual-energy X-ray absorptiometry (DXA) calculated by the sum of skeletal muscle mass in the arm and legs. Sarcopenia was evaluated by the Skeletal muscle mass index (SMI), which is calculated as (the appendicular skeletal muscle mass in kilogram divided by the square of the height in meters), Sarcopenia was defined as an SMI <5.5 Kg/m2 in women.

**Biological Markers (in serum):** IL-6 and α1-ACT, myoglobin, and C-reactive protein were measured in serum by using ELISA.

**Results**

Table 1 reveals that SMI in patients with RA were significantly lower (5.77 ± 0.85) than that in the healthy controls (6.27 ± 0.67). Concerning serum Myoglobin level these was no significant difference in RA patients from controls (14.83 ± 13.14 vs. 14.66 ± 13.06 respectively). The serum CRP level in RA patients were significantly higher (25.84 ± 4.52) than that in the healthy controls (18.09 ± 3.77), and the same was also for serum IL-6 level (36.77 ± 28.52 vs. 16.41 ± 8.28 respectively). In addition, Patients with RA showed a highly significantly increasing level of serum alpha-1 ACT (111.38 ± 58.31) compared to (57.84 ± 27.75) of healthy controls.

**Table 1: Assessment of different variables between RA patients and control**

<table>
<thead>
<tr>
<th></th>
<th>RA patients</th>
<th>Control</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td>58</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>SMI (Kg/m²), mean ± SD</td>
<td>5.77 ± 0.85</td>
<td>6.27 ± 0.67</td>
<td>0.006</td>
</tr>
<tr>
<td>Myoglobin (ng/ml), mean ± SD</td>
<td>14.83 ± 13.14</td>
<td>14.66 ± 13.06</td>
<td>0.954</td>
</tr>
<tr>
<td>CRP (pg/ml), mean ± SD</td>
<td>25.84 ± 4.52</td>
<td>18.09 ± 3.77</td>
<td>0.0001</td>
</tr>
<tr>
<td>IL-6 (pg/ml), mean ± SD</td>
<td>36.77 ± 28.52</td>
<td>16.41 ± 8.28</td>
<td>0.0001</td>
</tr>
<tr>
<td>α1ACT (ng/ml), mean ± SD</td>
<td>111.38 ± 58.31</td>
<td>57.84 ± 27.75</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

**Discussion**

This study shows a highly significant reduction in the SMI of patients with RA comparing to healthy controls. These results agree with the previous findings reported by Ceyhan et al that found a significant lower of SMI in patients with RA comparing to healthy controls, and by Westhovens et al which found that lean body mass was significantly lower in patients with RA comparing to healthy controls. The exact mechanisms that cause low muscle mass in RA are still not specific, but they appear to be multifactorial and include increased production of pro-inflammatory cytokines, mainly tumor necrosis factor-alpha and interleukin-1 beta, hormonal changes, oxidative damage, reduction of protein synthesis in myocytes, insulin resistance, inadequate protein ingestion, and reduction of physical activity. This condition may lead to a vicious cycle of lower exercise, increased fatigue and weakness, and increased fat mass with implications for comorbidity and mortality.
This study shows no significant changes in serum myoglobin level of patients with RA comparing to healthy controls. These results agrees with the previous findings reported by Sarzi-Puttini et al who found that patients with RA had normal serum myoglobin14. Myoglobin is associated with damage of skeletal or cardiac muscle, but not associated with muscle atrophy or hypertrophy15. This explains no changes in serum myoglobin level of RA patients with sarcopenia when compared to RA patients without sarcopenia (myoglobin level changes is closely associated with muscle damage not muscle mass loss)15.

This study shows a significant elevation in serum CRP level of patients with RA comparing to healthy controls, which agrees with other studies and found that the mean distribution of CRP in RA patients is higher than healthy control16.

This study shows a significant elevation in serum IL6 level of patients with RA comparing to healthy controls and this finding consistent with previous findings that reported by Rico et al, Chen et al and Liu et al that showed a significant elevation in serum IL6 level of patients with RA comparing to healthy controls17-19. The significant elevation in serum IL6 level of patients with RA in this study consistent with previous findings, that attributed IL6 overproduction to several causes, including interactions between T and B lymphocytes, synovial-like fibroblasts, and macrophages, IL6 also drives persistent inflammation and joint destruction20.

This study shows a significant elevation in serum alpha-1 ACT level of patients with RA comparing to controls, and this finding consistent with previous finding which reported by Kosaka et al that find a significant elevation in serum alpha-1 ACT level of patients with RA when compared to controls21, and by Brackertz et al that showed a significant rise in α 1-ACT in patients with rheumatoid arthritis. They found that the concentrations of α 1- ACT was also significantly higher as compared with those of the patients with osteoarthritis without inflammatory process 22. This difference is in agreement with the known fact that α 1-ACT belong to the group of acute phase proteins that respond to inflammatory stimuli with a substantial rise in concentration23,24.

**Conclusion**

The risk of sarcopenia is higher in RA patients in comparison to healthy controls of the same age. SMI was significantly lower in RA patients compared to healthy controls. There is no significant changes in serum myoglobin in RA patients compared to healthy controls because myoglobin level changes is closely associated with muscle damage but not muscle mass loss. There is a significant increase in serum CRP, IL-6 and ACT in RA patients compared to healthy control.

**Conflict of Interest:** None

**Ethical Clearance:** Informed written consent was obtained from all the participants in the study, and the study and all its procedure were done in accordance with the Helsinki Declaration of 1975, as revised in 2000. The study was approved by College of Medicine, Al-Mustansiriyah University

**Source of Funding:** The work were supported by authors only

**REFERENCES**


Rapid and Inexpensive DNA Extraction Protocol from Gram Negative and Gram Positive Bacteria

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ABSTRACT
The aim of present study to develop a novel, efficient, rapid and Inexpensive and effective protocol to extract DNA from gram negative and gram positive bacteria. Many protocols have been recommended for DNA extraction from bacteria, and almost all of them are difficult and time consuming, dealing with high amount of toxic materials like phenol and chloroform. In summary, results have described a cell lysis and DNA purification procedure that appears to be suitable for obtaining high-quality DNA from both gram-positive and gram-negative bacteria. The study was focused on a fast and reliable protocol with inexpensive and non-poisonous reagents for DNA extraction from different bacterial species, and the complete lysis and extraction procedure is carried out in a single microcentrifuge tube. Also the quality and quantity of the extracted DNA were surveyed by gel electrophoresis.

Keywords: DNA extraction, Rapid protocol, Efficient method

Introduction
DNA as a double helix molecule is composed of four nucleotides including, cytosine, guanine, thymine and adenine. In each strand these nucleotides are connected by phosphodiester bonds. Each strand is joined to another primarily through Watson, Crick hydrogen bonds. The point that the two strands cross each other forms two regions named minor groove. Many protocols have been recommended for DNA extraction from gram-negative and gram positive bacteria. However, these protocols are difficult and time consuming, utilizing high amount of toxic materials like phenol, and complex procedures like absorptive columns and sometimes detergents like CTAB (cetyl trimethyl ammonium bromide). Commercial kits are available too; however, they are expensive and sometimes unavailable. Presented here is a simple and rapid method for extraction of bacterial genomic DNA. This method is effective in producing digestible genomic DNA from a variety of gram-negative and gram positive bacteria, including those of the genera Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Staphylococcus aureus and Staphylococcus epidermidis. The most common problem affecting DNA purity, which can inhibit the activity of many molecular biological enzymes. The method also has several advantages of not requiring any enzymes for expensive cell lysis materials. It requires only one chloroform extraction, and the entire process can be accomplished within 15 minutes. In this study, the present result revealed a novel, rapid and easy procedure to isolate sufficient high quality DNA suitable for PCR amplification.

Material and Method
DNA Extraction Protocol:
1. Bacterial species were incubated at 37°C on nutrient agar for 24h.
2. Loopful of bacteria (one big colony) was mixed with 50 μL ddH2O in 1.5 ml of microcentrifuge tube by pipetting.
3. The cells were boiled at 95°C for 5 minutes to lyse the bacteria.
4. Cells were centrifuged at 5000 rpm for 5 minutes at room temperature.
5. Resuspend the pellet by pipetting to produce cell lysis.
6. 1 μL of cell lysis (in step 5) was diluted with 20 μL ddH2O and to be ready for total genomic DNA and PCR, or sored at -20°C until use.
Phylogenetic Analysis: The 16S rRNA gene of E. coli, K. pneumonia, P. aeruginosa, S. aureus and S. epidermidis were amplified by PCR protocol using bacterial DNA that extracted by gSYNC DNA extraction kit protocol of human blood and was used as a PCR template. PCR was performed with universal bacterial primers complementary to conserved regions of the 5 and 3 ends of the 16S rRNA gene, 27 F (forward) (5’ AGAGTTTGATCCTGGCTCAG-3’) and 1492 R (reverse) (5’–GGTTACCTTGTTACGACTT–3’).

Results

This study was developed rapid and easy procedure to isolate sufficient high quality DNA suitable for PCR amplification. 16S rRNA was used as a target gene to analyze the efficiency of this method in producing high-quality DNA for PCR amplification. Fig. 1 shows the results of DNA extracted from E. coli, K. pneumonia, P. aeruginosa, S. aureus and S. epidermidis using current protocol. While Fig. 2 illustrates typical PCR products from DNA obtained from different negative and positive bacterial species.

Discussion

The procedures used in the method described in this paper avoid the use of organic solvents, cheap and simple to be performed. Several samples can be processed at the same time, and the DNA extracted by this methodology yields sufficient DNA for many rounds of genotype analyses. In the work presented here, the current study described a fast, inexpensive and efficient protocol for high yield genomic DNA extraction from gram negative and gram positive. Also, in current optimized protocol omitted the need to use of CTAB, hazardous or toxic chemical such as phenol and enzymatic agents like RNase and Proteinase K.

Conclusion

This study was developed rapid and easy procedure to isolate sufficient high quality DNA suitable for PCR amplification.

Acknowledgements

Thanks go to my lab colleagues, seniors, and friends for their constant encouragement, help, and goodwill, which kept me going in preparation of this paper.

Conflict of Interest: None of the authors have any conflicts of interest to declare.

Source of Funding: The research was performed independently, there is no funding, influence over study design, analyses, manuscript preparation, or scientific publication.

Ethical Clearance: The project was approved by the local ethical committee in University of Thi-Qar.

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Correlation Between DMF-T/def-t and the Secretion of Salivary HBD-1 in Carious and Non-Carious Group of Children

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¹Staff of Lecturer in Department of Oral Biology, ²Staff of Lecturer in Department of Pediatric Dentistry, ³Undergraduated Student, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia

ABSTRACT

Background: DMF-T/def-t (Decay Missing Filled Teeth) is an index for assessing dental and oral health status, in this case, dental caries. Dental caries is a multifactorial disease with factors namely teeth and saliva, microorganisms, dietary, and time that affecting each other. Human Beta Defensins-1 (HBD-1) is an Antimicrobial Peptides (AMPs) that has a role as an adaptive immune system in oral health, is a factor that affects the susceptibility and development of dental caries that exhibits activity in Streptococcus mutans bacteria.

Objective: To prove the relationship between DMF-T/def-t and the levels of HBD-1 saliva secretion in the carious and non-carious groups of children.

Method: This study was an observational analytic with cross-sectional study design, with the division of 3 groups namely; group 1 (DMF-T/def-t = 0, caries-free), group 2 (DMF-T/def-t = 1-3, low caries), and group 3 (DMF-T/def-t > 6, high caries).

Result: DMF-T/def-t index (1,000) obtained HBD-1 concentration (-0.451). Low DMF-T/def-t index has high HBD-1 concentration, whereas high DMF-T/def-t index has low HBD-1 concentration. The value of p < (0.05) showed there was a significant correlation between the DMF-T/def-t index with salivary HBD-1 concentrations.

Conclusion: There was a relationship between DMF-T/def-t and the level of HBD-1 saliva secretion in the carious and non-carious groups of children.

Keywords: DMF-T/def-t, Saliva, Streptococcus mutans, Dental Caries, Human Beta Defensins-1

Introduction

Dental caries is the most common dental and oral disease found in the community, especially in children. Based on RISKESDAS 2013 data, caries prevalence in Indonesia reached 53.02%. Dental caries in Indonesia tends to increase over years. Dental caries is a multifactorial disease with causative factors, namely teeth and saliva, microorganism, dietary, and time that affecting each other. The main group that suffered dental caries was the age group of 6-14 years old with DMF-T index of 2.21.

DMF-T (Decay Missing Filled Teeth) is an index to assess the oral and dental health status, in this case is dental caries. D value is the number of cavities or decayed teeth due to dental caries, M value is the number of extracted teeth due to dental caries, F value is the number of filled or treated teeth due to caries and in good condition. The DMF-T value is the total of D, M, and F scores.¹²
To assess the health status of deciduous teeth, commonly used def-t index (decay exfoliated filling teeth). Def-t value is an index that shows the number of deciduous teeth with caries in 9-12 years old children. D value is the number cavities or decayed teeth due to dental caries, e value is the number of deciduous teeth loss due to premature loss or extraction that caused by dental caries, and f value is the number of filled or treated deciduous teeth due to caries. The def-t value is the total of d, e, and f scores.³

The bacteria of the oral cavity can cause inflammatory processes, inducing an innate or adaptive immune system response to the host. Cytokines regulate many aspects of the immune response. In leukocyte circulation, cytokines have been shown to affect the expression of associated chemokine adhesion. In the innate immune response system, pathogenic microbes of the oral cavity have a molecular bond form with similar forms of receptors on host cells, including dendritic cells that then activate the inflammatory response together with the release of proinflammatory cytokines, such as IL-1β, IL-6, IL-8 and TNF-α.⁴

So far several ways have been conducted to prevent the dental caries, among others by brushing your teeth properly, giving topical fluoride application and using mouthwash, but not showing maximum results to prevent dental caries. Some studies have shown that Antimicrobial Peptides (AMPs) are antibodies that provide a defense against pathogenic bacteria. This peptide is very important in the oral cavity and acts as an antimicrobial. Antimicrobial peptides (AMPs) in saliva are important contributors to maintaining a balance between health and illness as part of the host’s innate immune response. AMP is considered to affect the susceptibility and development of dental caries in oral health.⁵

Human beta-defensins (HBDs) are in a family of AMP, which have a role as an immune response. Human Beta Defensin-1 (HBD-1) is expressed in the oral cavity tissue and secreted in saliva. HBD-1 as innate immunity, as well as chemoattractants for T cells and dendritic cells in microorganisms. The expression of HBD-1 is constitutive, and physiological salivation is not known. This study aimed to investigate the relationship between DMF-T/def-t with salivary HBD-1 secretion as a new way to prevent caries and biomarker candidates for caries risk assessment.⁶

**Materials and Method**

This study was an observational analytic with cross-sectional study design, with the division of 3 groups namely; group 1 (DMF-T/def-t = 0, caries-free), group 2 (DMF-T/def-t = 1-3, low caries), group 3 (DMF-T/def-t > 6, caries high). The research sample was the saliva that taken from elementary school students who were caries-free and carious at Qomaruddin Gresik Islamic Boarding School that qualified the inclusion and exclusion criteria using purposive random sampling technique.

The research materials used saliva samples, Human Beta-defensin 1 ELISA Bioassay Technology Laboratory brand kit (anti HBD-1 antibody; streitavidin-HRP; wash buffer; substrate solution A; substrate solution B; stop solution). Research tool used; sterile conical cup, 15 ml cryovial tube, 1.5 ml eppendorf, refrigerator with temperature -30°C, ice box, mask, mouthpiece, straight round, handpiece, handscoon, centrifuge with a temperature of -4°C, micropipette, elisa microplate, microplate wash (Bio-Rad), ELISA reader (Bio-Rad microplate reader) and stopwatch.

The students who became research samples were asked to fill out the questionnaire. The questionnaires contained student identity, criteria for measuring DMF-T/def-t index in oral condition. Students were instructed not to eat about 1 hour before saliva collecting (allowed to drink water) and avoid to intake of sweet foods and those containing caffeine. Before the saliva collecting was conducted, the students were asked to rinse for 1 minute with clean and distilled water, after gargling, they had to wait for approximately 5 minutes. Saliva collecting was conducted at 8-10 am with the method of passive droll, which by bowing the head and saliva that collected in the mouth was taken out into the cryovial tube. Saliva samples that had been collected should be processed in the laboratory in less than 2 hours.⁷,⁸

The saliva sample was collected until reached 5 ml. The samples were stored in an ice box, then then stored in the refrigerator with a temperature of -30°C, so the sample could survive for long periods of time.⁹

**Sample Preparation:** The cryovial tubes were removed from the refrigerator and kept in the area at a room temperature, then centrifuged at 2400 g for 10 minutes, -4°C. The centrifugation was carried out in order to separate the supernatant in saliva, the supernatant would form clearly after centrifugre, separate from cells that contained in whole saliva.⁹ The supernatant was put into the eppendorf tube and stored in a refrigerator at a temperature of -30°C until the ELISA test time was conducted.
**ELISA Sandwich Procedure:** Salivary supernatant samples were removed from the refrigerator until they reached room temperature. The ELISA kit was removed from the refrigerator for approximately 30 minutes until all reagents reached room temperature. A sample of 40 μl of salivary supernatant was put into the well, then 10 μl of anti-HBD-1 antibody, and then 50 μl of streptavidin-HRP. Samples of saliva supernatant and reagent in plate were mixed using micromixer. The plate was covered with a sealer and incubated in a dark room at temperature of 37°C for 60 minutes. The wash buffer dissolved was prepared in distilled water in a ratio of 10 ml : 290 ml, then put into a microplate wash tube. The sealer was removed from the plate and the microplate was put into a microplate wash. The plate was washed 5 times, then dried by tapping lightly to dry.

The substrate solution A and substrate solution B were added to each well. When adding the substrate solution, the researcher must avoid the sunlight exposure directly. The plate was covered again with a sealer then incubated in a dark room at a temperature of 37°C. A 50 μl stop solution was put in each well. ELISA readings was with OD results and the concentration levels was used a microplate reader with a wavelength of 450 nm.

**Result**

The results of this study showed the levels of HBD-1 in carious and caries-free children were obtained from 3 groups; namely the DMF-T/def-t group = 0 (free caries), DMF-T/def-t = 1-3 (low caries), DMF-T/def-t => 6 (high caries). Before examination was conducted, all groups performed oral cavity examination first, to obtain DMF-T/def-t index. Then 5 ml of saliva was taken and divided according to caries-free criteria, low DMF-T/def-t index, and high DMF/def-t. The data was collected in 9 times visit on September 11st - November 15th, 2017 at Pondok Pesantren Qomaruddin.

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>DMF-T/def-t</th>
<th>HBD-1 Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Group 1 (caries free)</td>
<td>0</td>
<td>1000.8 ± 339.38</td>
</tr>
<tr>
<td>Group 2 (low caries)</td>
<td>1.86 ± 0.83</td>
<td>1036.8 ± 366.9</td>
</tr>
<tr>
<td>Group 3 (high caries)</td>
<td>7.80 ± 2.68</td>
<td>709.93 ± 243.30</td>
</tr>
</tbody>
</table>

The Table 1 showed the caries-free group as a control resulted the mean of DMF-T/def-t score of 0 (caries-free) and mean of salivary HBD-1 concentration was 1000.8 ± 339.38 pg/ml. The low caries group with low DMF-T/def-t resulted the mean of DMF-T/def-t score of 1-3 (low caries) was 1.86 ± 0.83 and the mean of HBD-1 concentration was 1036.8 ± 366.9 pg/ml. The high caries group with high of DMF/def-t score more than 6 (high caries) resulted the mean of DMF-T/def-t of 7.80 ± 2.68 and the mean of HBD-1 concentration was 709.93 ± 243.30 pg/ml.

Before saliva HBD-1 levels test was conducted, the data was firstly analyzed for its normality and homogeneity of data. Normality test was performed by Kolmogorov-Smirnov test, showed the probability of each treatment groups. The group 1 was with alpha value of 0.5 so the data distribution of DMF-T/def- t was normal. While the group 2 and group 3 were with alpha value more than 0.5, so the data distribution were normal concentrate.

Table 2: Spearman’s test results

<table>
<thead>
<tr>
<th>Spearman’s Test</th>
<th>DMF-T/def-t</th>
<th>Concentration</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.000</td>
<td>-0.451</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Table 2 contains the results of Spearman’s test that showed p value of 0.002, which the alpha value is less than 0.05, that means there was a significant correlation between the DMF-T/def-t scores and the salivary HBD-1 concentration. The value of r < 0 indicates that the correlation between DMF-T/def-t scores and the salivary HBD-1 concentration was inversely related. That means low DMF-T/def-t was associated with high levels concentration of salivary HBD-1, whereas high DMF-T/def-t was associated with low levels concentration of salivary HBD-1.

**Discussion**

This study was conducted to determine the relationship between DMF-T/def-t and salivary Human Beta Defensin-1 (HBD-1) secretion in carious and caries-free children groups. Before sample grouping based on the DMF-T/def-t scores was conducted, the samples were examined their oral cavity using DMF-T/
def-t index. The 5 ml saliva sample was placed in the centrifuge tube and divided into two groups, namely low DMF/def-t and high DMF/def-t. The results of this study showed there were a different levels of salivary HBD-1 in the low DMF/def-t group and high DMF/def-t group. This research involved elementary students of Qomaruddin Gresik Islamic Boarding School, which provides a dental treatment facilities.

The results of mean HBD-1 concentration in caries-free condition was 1000.8 ± 339.38 pg/ml. Salivary HBD-1 levels in the oral cavity can be measured in normal conditions because the peptides can be detected. Salivary HBD-1 is produced when inflammation occurs, in the salivary epithelial tissue and the gingival crevicular fluid.10

HBD-1 has the role of preventing commensal bacteria in the oral cavity differentiate into pathogenic bacteria. While salivary HBD-2 and HBD-3 are the antimicrobials, which are inducible, the levels may increase because of the stimulation of microbes, and have a major role against pathogenic bacteria.11

In the low caries group was with the mean of DMF-T/def-t scores of 1.86 ± 0.83 and the salivary HBD-1 concentration was 1036.8 ± 366.9 pg/ml. The presence of low frequency caries is because the pathogenic bacteria is inhibited by the activity of HBD-1. While the high caries group with the mean of DMF-T/def-t scores of 7.80 ± 2.68 and the salivary HBD-1 concentration was 709.93 ± 243.30 pg/ml. This is because HBD-1 is unable to inhibit the pathogenicity of cariogenic bacteria, then it is replaced with HBD-2 which strengthen the antimicrobial activity against the invasion of pathogenic bacteria, resulting in decreasing the levels of HBD-1.10

HBD-2 is produced when there is a chronic inflammation and the inflammatory mediator that can increase HBD-2 production, namely IL-1β, IFN-γ, TNF-α, IL-6, IL-8.4 From the results of this study, it is known that DMF-T/def-t and the salivary HBD-1 concentration are the new biomarker candidates for dental caries risk assessment to prevent dental caries. Streptococcus mutans is a dental caries etiology factor and has been studied extensively on the relationship between dental caries and S. mutans. Several studies also assessed the association between the development of carious lesions with immunocompetent cell responses. Cytokines are an important mediator during inflammation and infection, in addition to the role of controlling the inflammatory response to bacterial infections. The host’s active cells secrete these molecules as paracrine or autocrine signals to recruit immune system cells (chemokine), produce inflammation (proinflammatory cytokines) or regulate inflammatory responses (anti-inflammatory cytokines). The role of cytokines in dental caries pathogenesis is not clearly, but the production of proinflammatory cytokines can be induced by S. mutans components.12,13

Conclusion

Based on the results of this study, we can conclude that there was a relationship between DMF-T/def-t and the level of HBD-1 saliva secretion in the carious and non-carious groups of children. The correlation between DMF-T/def-t scores and the salivary HBD-1 concentration was inversely related.

Acknowledgements

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Source of Funding: This study was done with individual funding

Ethical Clearance: This study had received a letter of approval for ethical clearance on human subjects from the Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia, with number 132/HRECC.FODM/ VIII/2017.

REFERENCES


Study of Kidney Pathological Investigation in Some Cases of Diseases Chickens

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ABSTRACT

In this study, fifty samples of chickens kidney were collected from different chicken farms in Diyala province to study the pathological lesions (gross and histopathology). The gross appearance revealed different shapes of kidney vary from small size and the paleness of the kidney while the histopathological changes showed necrosis which lead to epithelial lining desquamation of renal tubules. There is an inflammatory cell infiltration specially lymphocytes in the kidney interstitial tissue. Other cases, the histopathological changes in it revealed mesengial cell proliferation of kidney glomeruli and in interstitial tissue observed presence of hemorrhage. In other samples, there is a hyaline degeneration and severe hemorrhage in renal glomeruli. Same samples showed clefts of urates in the renal tubule lumen recorded as visceral gout with inflammatory cell infiltration specially macrophages and foreign body giant cells. Congestion of blood vessels and interstitial tissue hemorrhage. In this study and from the results the concluded, revealed the gross and histopathological changes associated with many chicken diseases.

Keywords: chickens, kidney, histopathology, nephrosis, gout

Introduction

The interest in livestock, including chicken, plays an important role in the process of development and raising the economic level of society. Poultry raising meat and eggs is one of the most vital industries in the world because it has become an appropriate substitute for other protein sources. The poultry industry is characterized by low production costs as well as high nutritional value (1, 4). So it is necessary to improve livestock and attention through control of diseases that affect chickens, including diseases of the urinary system, especially the kidneys. Kidneys are organs that play a special role in the balance of water and electrolytes and rid the body of the nitrogenous waste produced by the protein metabolism (2, 3). During the breeding period, the urinary system can be exposed to lesions and pathological changes for possible administrative reasons such as exposure to low or high temperatures or exposure to bacterial and viral infections (5) or as a result of an imbalance in the basic components of the diet such as protein and calcium (6, 7, 8), this may be due to their interest in viral and bacterial diseases that cause economic losses and losses in chicken herds and lack of focus on renal changes. Therefore, I wanted to shed light on the pathological changes that affect the urinary system, especially the kidneys, by studying the gross and histopathological changes of the kidneys associated with some different diseases in the chicken breeding fields.

Material and Method

The study was conducted in different regions contain chicken fields in the province of Diyala for the period from October 2018 to December 2018, as the study was based on the examination of chicken, which is marked by diseases signs or of the newly deceased chickens, where the field visits were assigned to a weekly field of some fields of chickens and chickens were brought sick or newly deceased to the laboratory of poultry diseases/Faculty of Veterinary Medicine at the University of Diyala for a comprehensive study including the description of kidney lesions after the examination of the chicken, and some of them documented by images. Fifty samples of kidney were collected after the examined of the newly infected and diseased chicken.

The samples were put directly in 10% neutral formalin solution to fix them for 24-48 hours and then cut into small pieces 1 cm³, then carried out the process
of ascending alcohols and then in xylene, waxed in the form of molds and cut the pieces with a microtome on thickness of (4-5) μm and then dyed with the routine stain hematoxylin and eosin10.

Results

The gross pathological lesions included congestion and hemorrhage spots on the kidney cortex (figure 1), in some cases the kidney presented small in size and paleness than other cases.

Other cases, the kidneys congested with hemorrhage spots and lobulated (figure 2). Some cases of the kidneys showed lobulated and the lobules filled with urate, others kidneys paled, poetical hemorrhage on the cortex (figure 3), (Table 1).

Histopathological Changes: The histopathological lesions of the kidneys showed vascular degenerative changes in the endothelium of renal tubules with necrosis (figure 4), also there is a proliferation and hyperplasia of the arterioles mesothelioma (figure 1), cellular proliferation of glomeruli mesengial cells (figure 3), while the other glomeruli mesengial cells showedatrophy with distention of Buman capsule (figure 3, 4).Swelling of renal tubules endothelium with the narrowing of it and presented of star shape, desquamation of the renal tubule epithelium, congestion of blood vessels, hemorrhage and tubular dilation (figure 4), proliferation of inflammatory cells, especially the neutrophils (figure 5). Other cases revealed severe hemorrhage in kidney with congestion of blood vessels and hyaline degeneration in renal glomeruli that present as homogenous pink mass (figure 5).

The histopathological changes showed a visceral goat with degeneration in renal tubules characterized by deposition of urates crystals as cleft were distributed radially in the cavity of the renal tubules, these crystals were surrounded by cellular clusters of phagocytes and foreign body giant cells forming several granular lesions in the blood vessels between renal tubules and presence of hemorrhage in other regions (figure 4, 5).

Table 1: Intensity of gross lesions of kidney samples in different disease cases

<table>
<thead>
<tr>
<th>Gross pathological changes</th>
<th>Severity of injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney congestion and swelling</td>
<td>+++</td>
</tr>
<tr>
<td>Kidney congestion and swelling with hemorrhagic spots on capsule</td>
<td>++</td>
</tr>
</tbody>
</table>

Table 2: Intensity of histopathological lesions of kidney samples in different disease cases

<table>
<thead>
<tr>
<th>Histopathological changes</th>
<th>Severity of injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degenerative changes</td>
<td>+++</td>
</tr>
<tr>
<td>Necrotic changes</td>
<td>++</td>
</tr>
<tr>
<td>Congestion of blood vessels</td>
<td>+++</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>++</td>
</tr>
<tr>
<td>Hyaline degeneration of glomeruli</td>
<td>++</td>
</tr>
<tr>
<td>Inflammatory cells infiltration</td>
<td>++</td>
</tr>
<tr>
<td>Visceral gout</td>
<td>++</td>
</tr>
<tr>
<td>Blood vessels wall changes</td>
<td>+</td>
</tr>
<tr>
<td>Renal glomeruli atrophy</td>
<td>++</td>
</tr>
</tbody>
</table>

+++ very sevir, ++ moderate intensity, + low intensity
Discussion

The best description of the urinary tract specially the kidney was by (17) he said the determined of kidney lesions done by study the case history, field management, gross lesions and histopathological lesions which considered necessary for identifying the different diseases. (9, 10, 11) said this change may be occurring when infected with viral diseases such as Newcastle in chickens. also (5, 11, 12) observed same pathological changes through experimental infection by E. coli. (14) recorded the congestion, paleness of kidney with hemorrhagic spots on cortex of kidney, same changes observed in chickens, which infected with Streptococcus and Salmonella, the hemorrhage in kidney cortex usually results from septicemic diseases which characterized by inflammation of blood vessels in addition to the necrosis and this observed in pigs infected with Hog cholera (15). Others cases the kidney characterized by paleness, shrinkage and irregular shape and observed in chronic nephritis (11, 12), this same result described by (16) which mentioned the paleness and shrinkage of the kidney caused by kidney hardness.

The histopathological changes showed degenerative changes in the renal tubules characterized by visceral type and this observed with (17, 18) which mentioned the visceral degenerative changes of renal tubules occurred in case of electrolyte imbalance, particularly sever decrease of potassium due to thirsty, increase of temperature, also degenerative changes result from ischemia, hypoxia and sensitive of the cells for some toxins (14, 17, 19) observed visceral changes and renal glomeruli changes which represent, by the increase proliferation of mesengial cells, this change occurred in chickens when infected by Streptoccous zooepidemicus and in human occurred in the case of infected with pregnancy septicemia (21, 22). The causes of this histopathological changes result from increase of sodium ion in blood, which result in hypertension and increase blood pressure for the long period lead to arteriosclerosis, hyaline degeneration in artery and arterioles of kidney and result in atrophy of renal tubules (16, 23). The histopathological changes for other cases revealed severe degenerative changes and necrosis of the interstitial tissue and renal tubules with inflammatory cell proliferation in addition to hemorrhage and this change occurred in the case of infected withmicroorganism to the kidney by hematogenous methods causes penetration.
of germs to blood vessels which result in visculitis and inflammatory cell infiltration of interstitial tissue with necrosis of renal endothelial cells \(^{(10, 11, 12, 24, 25)}\), observed hyaline degeneration of renal tubules and same changes \(^{(20, 26)}\) in chickens treated experimentally with Afla, B1 toxin which considered characteristic lesion for this disease, the histopathological changes of some cases characterized by lymphocyte infiltration of interstitial tissue with degenerative changes in renal glomeruli and tubules, Such changes were observed by \(^{(27)}\) in chicken infected with Gumboro, this is due to the severe dehydration that infected chicks in Gumboro and inability to move and drink water. The histopathological section of kidney observed visceral gout, which characterized by sever degenerative changes in the renal tubules represented crystals of urate in renal tubule lumen \(^{(28)}\), and this case developed because of absence of uricase in chickens \(^{(7)}\). The visceral gout can occur experimentally in chickens by giving nephrotoxic agents for kidney such as gentamycin in high doses, nutrition with low vitamin A and decrease of calcium \(^{(29)}\). The urate crystals consider foreign body lead to formation of granuloma \(^{(7)}\), and the renal tubules surrounded by inflammatory cells (macrophages, foreign body giant cells) and there is congestion of blood vessels between renal tubules and hemorrhage spots in other \(^{(30)}\).

All previous presentation showed nephrosis and nephritis can occurred due to multiple causes, toxic causes \(^{(12)}\) or nutritional causes result from increase rate of lipid, proteins, calcium and decrease vitamin A in the diet \(^{(31, 32)}\).

Also the infection with bacterial and viral caused renal lesions specially viral infection such as infectious bronchitis and Gumboro and all these lead to pathological changes in the kidney \(^{(33)}\).

In this study the results are approximately similar to the results mentioned by Siller. \(^{(17)}\).

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** Not Required

**REFERENCES**


Incidence of Unscarred Uterine Rupture: A Prospective Four Years Duration Study

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ABSTRACT

Background: Uterine rupture is a known catastrophic event in obstetrics, often resulting in both maternal and fetal consequences. This event occurs more in developing countries, with a varying global incidence.

Objective: To assess the incidence and the main causes of the rupture uterus.

Patients and Method: This was a four years prospective cross-sectional descriptive study done in 4 years duration, from the first of 2015 to the end of 2018, involving all cases of delivery at Al-Elwiah teaching hospital. The hospital serves as a major referral center for Obstetrics and Gynecology in Baghdad Al-Resafa, (n=32246) women who delivered at the hospital in this period.

Results: The women age between 15-40 years old, and out of 32246 of women who delivered in our hospital about (n=148) of cases was undergo ruptured uterus, giving a rupture rate of 4.6 per 1,000 births, 44.6% (n=66) of these cases of rupture occurred in unscarred uterus (2/1000) and the rest with scared uterus. Most of the cases of unscarred rupture were aged between 26 and 35 years, and had parity of 3 or above.

Conclusion: The incidence of unscarred rupture uterus was (2/1000) and the main cause was multiparty and delivery by midwife.

Keyword: Unscarred uterus, multiparty, midwife, Al-Elwiah teaching hospital.

Introduction

Uterine rupture is the solution of continuity of the uterine wall in the gravid uterus. They can be produced both in a healthy uterus and with a previous scar. (1,2) It is one of the rare obstetric complications. The systematic review carried out by the WHO shows that the prevalence is lower in developed countries (0.006%) than in underdeveloped countries (25%). (3) The incidence of uterine rupture on unscarred uterus is very rare in developed countries, of the order of 1/20,000 deliveries, (4) not exceeding 30% of the total uterine rupture. They concern in 60 to 80% of the cases the lower segment, preferably the anterior surface. (5)

Risk Factors: This is mainly related to multiparty, prolonged labor, illiteracy and lack of access to health services. (6-9) However, in developed countries, the most frequent cause would be previous uterine surgery. (10,11) Other risk factors that contribute to the presence of a break are: (3)

1. Intrinsic weakness of the wall (Ehlers disease - Danlos type IV) or abnormal architecture of the uterus (bicormuate, didelfo, etc.) (12)
2. Great multiparity.
3. Reduced intergenic interval (<18-24 months)
4. Advanced maternal age.
5. Obesity (body mass index> 40).
6. Macrosomia (> 4,000 g).
7. Abnormal placentation (placenta accreta, increta or percreta).

Corresponding Author:
Dr. Shaymaa Jaafar
Email: shaimaashimary@yahoo.com
8. Hysterorrhaphy in a single layer.
9. Previous uterine surgery.
10. Use of uterotonic (oxytocin and prostaglandins).
11. Traumatic obstetric maneuvers (instrumental delivery, third trimester abortions, version and great shoulder dystocia extraction, external version, etc).
12. Short stature. \(^{(13)}\)

**Objective**

To assess the incidence and the main causes of the rupture uterus.

**Patients and Method**

This was a four years prospective cross-sectional descriptive study done in 4 years duration, from the first of 2015 to the end of 2018, involving all cases of delivery at Al-Elwiah teaching hospital at the time of the study. The hospital serves as a major referral center for Obstetrics and Gynecology in Baghdad Al-Resafa, 31246 women who delivered at the hospital in this period.

Data was collected by a specially designed format and by direct interview with the patients before they were discharged. Information was also collected from patient’s case notes, maternity ward records and operating room registers in a structured format.

**Statistical Analysis**

After the data were entered in a table developed by the researchers, the analysis was done by using the SPSS program, version 23 and for qualitative variables, we used frequencies and percentages, and for the quantitative variables, we used measures of central tendency and dispersion (standard deviation). For the inferential statistics the tests were used of chi-square test (with a significance of P ≤0.05).

**Results**

Out of 32246 of women who delivered in our hospital we found that (148) of cases was undergo ruptured uterus, giving a rupture rate of 4.6 per 1,000 births, 44.6 % (n=66) of these cases of rupture occurred in unscarred uterus (2/1000) and the rest with scared uterus (figure 1). Most of the cases of unscarred rupture were aged between 26-34 years, and had parity of 3 or above was with significant association with unscarred uterus than those without (table 1).

**Figure 1: distribution of types of ruptured uterus (N = 148)**

**Table 1: Age and parity of the studies group (148)**

<table>
<thead>
<tr>
<th></th>
<th>Scarred uterus (N = 82)</th>
<th>Unscarred uterus (N = 66)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤25 years</td>
<td>19</td>
<td>23.2</td>
<td>17</td>
</tr>
<tr>
<td>26-34</td>
<td>55</td>
<td>67.1</td>
<td>43</td>
</tr>
<tr>
<td>≥35</td>
<td>8</td>
<td>9.7</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>82</td>
<td>100.0</td>
<td>66</td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td>29.6 ± 4.1</td>
<td></td>
<td>27.2 ± 3.5</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>38</td>
<td>46.3</td>
<td>5</td>
</tr>
<tr>
<td>≥3</td>
<td>44</td>
<td>53.7</td>
<td>61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>82</td>
<td>100.0</td>
<td>66</td>
</tr>
</tbody>
</table>
Table 2: The association between time and site of labor in unscarred uterus patients (N = 66)

<table>
<thead>
<tr>
<th>Duration of labor</th>
<th>Site of labor</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In home by (midwife)</td>
<td>In hospital</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>&lt; 12 hours</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>12-24 hours</td>
<td>12</td>
<td>26.7</td>
</tr>
<tr>
<td>&gt; 25 hours</td>
<td>31</td>
<td>68.9</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 2: Final outcome of mother and fetal of unscarred uterus (N = 66)

<table>
<thead>
<tr>
<th>Common cause of rupture</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Multipara ≥3</td>
<td>61</td>
<td>92.4</td>
</tr>
<tr>
<td>2. Abnormal placentation</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>3. Malpresentation</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>4. Chronic use of corticosteroid</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>5. Instrumental delivery</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Discussion

Rupture of the uterus is one of the terrible events in obstetrics with bad fetal and maternal consequences. with more incidences in developing than developed countries. The incidence of uterine rupture in the current study was 4.6 per 1,000 births, 44.6% (n=66) of these cases of rupture occurred in unscarred uterus (2/1000) which is less than that found by Eguzo KN et al., when the incidence of unscarred uterine rupture was 8.4/1000 live birth and it represent 40% of all cases of rupture uterus in his hospital during period of the study. But it is still larger than that registered in the world where the incidence of ruptured uterus was 1/8000-1/15000. (20)

The most common cause of uterine rupture in the current study is the multiparity >3, then instrumental used in delivery, mal-presentation, chronic corticosteroid drug use and abnormal placentation in addition to the delivery by midwives. This is in agreement with that found by Berghahn L et al., and by Hamilton E et al.

The long term used of corticosteroid may be lead to rupture of the uterus; and as Hamilton E et al, explained that this because the medications can lead to decreased synthesis of the collagen and causing uterine rupture.

The maternal mortality rate was (13.6%) and fetal mortality rate in the current study was (22.7%) which is considered very high and need prompt effective management. But it is still less than that mentioned by Schrinsky and Benson, in their study, when maternal and fetal mortality rate represents 20.8% and 64.6%, respectively. (23)

Conclusion

The incidence of unscarred rupture uterus was (2/1000) and the main cause was multiparity and midwives delivery interference.

Conflict of Interest: There is no conflict of interest by the authors

Source of Funding: Self

Ethical Clearance: Taken from the scientific committee of the Iraqi Ministry of health

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Effect of Therapeutic Exercises in Improving the Intensity of Muscle Contraction of the Thigh Muscles

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Ministry of Education, Hilla High School for Excellence, PhD. Sports Rehabilitation, Iraq

ABSTRACT

In addition to the problem of research, which crystallized that there are shortcomings in the treatment of some sports injuries that did not deal with the treatment of exercises and the lack of studies that dealt with the severity of muscle contraction of the muscles of the thigh and that this injury lead to dysfunction of the muscles of the thigh and the difficulty of exercise sports Especially football, which requires high physical qualities and functional efficiency that qualify him to practice the game.

Therefore, the researcher worked hard to give therapeutic exercises to qualify the injury of muscle contraction of the thigh muscles.

Keywords: thigh muscles, therapeutic exercises, muscle contraction.

Introduction

The world has witnessed great progress in the fields of various sciences, such as rehabilitation and sports medicine, which deals with the study of sports injuries, which has a strong relation to sports education. As a result of the high effort exerted by the player in different sizes is subjected to muscle contraction because it is a strain on the main components of the joints of ligaments and cartilage and muscle tendons.

Including the contraction of the thigh muscles. The game of football from the first games in which such injury occurs as a result of muscle strain during the period of effort and that injury means depriving the player to play for a period and thus affect the level of the athlete so the researcher decided to prepare rehabilitation exercises to qualify the injury of muscle contraction of the thigh muscles Football players.¹

Therapeutic exercises are important in the treatment of part of the body injured in one of the injuries or diseases, which led to weakness or lack of movement and each patient must be a special program depending on the diagnosis of his condition and the need for different movements of exercise.

Due to the scientific progress achieved in the field of rehabilitation and physical therapy, there are shortcomings in the provision of rehabilitation exercises for sports injuries and due to the lack of studies that help in the rehabilitation of muscle contraction of the muscles of the thigh, the researcher decided to prepare therapeutic exercises to reduce this injury during the exercise of sports.

Repeated muscle fatigue causes chemical changes in the synovial liquids within the joints of the body in general and within the big joints in particular. As a result the liquids e joints become less fluidity and more viscosity. Repeat occurrence of this leads to adhesion in the articular ligament which results in fibrosis and sclerosis and completely lack of flexibility. Reaching this point makes the person feel the pain of Arthritis which gradually turns to the severe pain of joints and the disability of the joints to move and act naturally, eventually the surrounding ligaments and the strings of the joints become hard and tough.²

Research Aims

1. Preparation of exercises for the treatment of muscle contraction of the thigh muscles.
2. To identify the effect of therapeutic exercises in the rehabilitation of the intensity of muscle contraction of the thigh muscles.

**Research Hypotheses:** Therapeutic exercises have a positive effect in the treatment of muscle contraction of the thigh muscles.

**Research Fields:**

1. **The Human Field:** 10 injured football players representing the clubs of Babel and praise and students of the University of Babylon.

2. **Time Field:** for the period from 19/6/2016 until 1/3/2017

3. **Place Field:** Hila Teaching Hospital/ Rehabilitation Center for Wounded/Babel.

**Research Methodology and Field Procedures**

**Research Methodology:** The researcher used the experimental method in a one-group method with sequential measurements to suit the nature of the problem.

**Community and Sample Search:** One of the components of scientific research is the selection of the appropriate sample, which is based on the study. The research community consisted of athletes with muscular contraction of the thigh muscles as they were determined intentionally after their diagnosis at the Babil Physical Rehabilitation Center (20) of the football players.

The study sample was randomly selected from the research community by 10 patients with muscle contraction of the hip muscles. They represent the clubs of Babel, Al-Madhatia and the students of the University of Babylon. The researcher excluded 10 reasons for which 4 of them had complex injuries, including cruciate ligaments and 3 underwent surgical intervention. And (3) did not have a desire to adhere to therapeutic exercises and the reconstruction of the research sample, which underwent the main experiment in the reconstruction (18-25 years) and after the selection of the sample was conducted homogeneity.

**Means, Tools and Devices Used in Research:** Due to scientific progress, the researcher tried to use the latest methods, methods and techniques in the diagnosis and use the latest methods of physical therapy that benefit the researcher in the removal of muscle contraction research subjects, and know the research tools as “the means by which the researcher collects his data.”

**Machines and Tools Used in Research**

<table>
<thead>
<tr>
<th>Device name</th>
<th>Originating Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser Type infra-red 4K - 533</td>
<td>Made in Germany in 2006</td>
</tr>
<tr>
<td>Zimmer electric stimulation</td>
<td>Made in Japan</td>
</tr>
<tr>
<td>device for the year 2007</td>
<td></td>
</tr>
<tr>
<td>Quadriceps device</td>
<td>Made in Japan</td>
</tr>
<tr>
<td>Tape measure type linen</td>
<td>Made in China</td>
</tr>
<tr>
<td>Medical Balance</td>
<td>Made in Korea</td>
</tr>
</tbody>
</table>

**Research Method**

1. Observation.

2. Testing and measurement.

3. Questionnaire.

**Survey Questionnaire:** The questionnaire is one of the important means to collect the information needed by the researcher. The questionnaire is defined as “the only convenient way to expose respondents to select and carefully selected stimuli for data collection.”

Therefore, the researcher prepared a questionnaire to obtain some information that we would like to obtain in relation to the subject of research, through the scientific sources have been identified a set of tests and measurements and then presented the questionnaire to a number of experts in the field of sports medicine and rehabilitation.

**Characterization of Tests and Measurements in the Research:**

**Measure the Circumference of the Thigh Muscles:**

The measurement of the ocean through the measuring tape. The method of fixing a point on the upper third of the femur is determined from the upper edge of the patella to the top by 15 cm. The length of the injured is between 160-170 cm.

**Equipment and tools used in treatment and rehabilitation:**

**Quadriceps Strengthening Chair:** Helps to strengthen the muscles and reduce pressure on the knee joint consists of the quadriceps of the handle distributed on both sides, which puts weights of differentiation ranging from half a kilogram to more up to 50 kg, used in physical therapy and medical rehabilitation.
**Electric Stimulator:** Is a set of devices that rely on the stimulation of electrical muscles and nerves by the poles of the treatment, which increases the range of motor joints and increase muscle strength and reduce spasm.

In the view of the researcher that the use of electrical stimulation of the muscles near the injury led to a significant and significant development in the increase in muscle strength and the stimulation of positive lengths through the program muscle training Volta (2 - 14) MA to (4 - 17) MA, Pain is used for cartilage, tearing, and muscular spasm.6

**Field Research Procedures:** The researcher examined the possibilities available in the medical rehabilitation and physiotherapy centers at the Hilla Teaching Hospital and Rehabilitation Center for the wounded.

**Identification and Diagnosis of Injury:** The researcher used the doctors to perform the clinical examination of the patients by x-ray, which contributed to the diagnosis of the injury.

**Exploration Experience:** It is important in the scientific research to conduct the exploratory experiment in order to obtain accurate and reliable results where we mean by “a mini-experiment similar to the real basic experience”.6

The researcher conducted a pilot experiment on 19/6/2016 on a group of injured (5) injured in the rehabilitation center of the wounded and the hospital Marjan Babil province. Where the aim of the experiment is to identify the obstacles that may accompany the tests and work to avoid and overcome if any. As well as knowing enough staff members and training them on tests.

**Scientific Processes for Testing:** The honesty, consistency and objectivity of the conditions must be enjoyed by each particular test. The researcher sought to determine the validity of these tests and be able to apply them to the research sample.

**Pretest:** The pretests were conducted on Monday 24/6/2016 at 10 am in the rehabilitation center for the wounded in the center of Babil governorate. The researcher took into consideration the conditions related to the test (place, tools, supplies, method of implementation, auxiliary team) to be available in the final exam (post-graduate).

**Therapeutic Exercises:** The researcher prepared therapeutic exercises for the injured (individuals of the research sample in one group). Appendix (2) taking into account the equipment, equipment and means available to help continue to work in the implementation of the proposed exercises in order to achieve the stage of recovery or reduce muscle contraction. Where the duration of the implementation of the exercises were for the period from 26/6/2016 until 26/10/2016, equivalent to 16 weeks and 48 units, equivalent to (3) units per week. The duration of the unit (120 minutes) was done using therapeutic exercises and the total number (96 hours).

**Post Measurement of the Search Group:** After the completion of the therapeutic exercises, tests were carried out after the test sample on 28/10/2016 at 10:00 am taking into account the stability in the spatial and temporal conditions and means and tools for tribal testing and with the help of the work team.

**Results and Discussions**

View and analyze the results of tribal and remote tests to measure the perimeter of the muscles of the thigh and discussed:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pretest</th>
<th>Posttest</th>
<th>(Z) Value</th>
<th>Level of significance</th>
<th>Significance of differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Measuring thigh circumference</td>
<td>40.540</td>
<td>5.925</td>
<td>45.460</td>
<td>7.252</td>
<td>2.805-</td>
</tr>
</tbody>
</table>

Through the extracted data, as shown in the table above appears that the mean of the test of tribal and adult (40.540) smaller than the mean of the test posttest of (45.460) as well as the standard deviation of the test posttest of (7.252) greater than the standard deviation of the test tribal (5.925) and knowledge of spirits differences using test and Cookson appeared that the value of (Z) amounted to (2.805).

Compared with the level of significance (0.005), there were significant differences in favor of the post-test. The rehabilitation program has a positive effect on the
measurement of the circumference of the thigh muscle. The researcher attributed this to the fact that the use of the training equipment for the rehabilitation exercises improved the work of the knee joint which protects the cartilage and ligament from The injuries confirmed by Kassem Hassan Hussein that “often get dangerous injuries in the framework of the training of the special force, therefore emphasizes the use of exercises for both public and private forces to strengthen the muscles of the thigh and legs”.

View and Analyzing and Discussing the Results of (Pre, Middle And Post) Tests for Measuring the Circumference of the Knee Joint:

Table 2: Counting the Mean &standard deviation & Freedman’s value among the (Pre, Middle and post) tests for sample search for the injured people who suffer from the partial longitudinal rapture of the cartilage of the knee joint for counting the circumference of the knee joint

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tests</th>
<th>Mean</th>
<th>SD</th>
<th>Counted Freedman’s value</th>
<th>Level of significance</th>
<th>Significance of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>counting the circumference of the knee joint</td>
<td>Pre</td>
<td>37.970</td>
<td>1.182</td>
<td>18.667</td>
<td>0.000</td>
<td>Sig.</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>35.940</td>
<td>1.423</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>post</td>
<td>35.350</td>
<td>1.701</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The data in this table shows that the value of the mean for the primary test (37.970) in the standard deviation (1.182) and the value of the mean for the Middle test (35.940) in the standard deviation (1.423). While the value of the mean for the post test (35.350) in the standard deviation (1.701), comparing with the Middle test and with the use of Freedman’s test to realize the Incorporeal difference, it appeared that there are Incorporeal difference with statistical indication among the (Pre, Middle and post) tests for the post tests. You can see the counted Freedman’s value (18.667) as compared with the level of significance (0.000). This shows that there is a difference for the post test due to the reduction in the value and the reason behind that is the dispose of the liquids in the circumference of the knee joint which accumulated as a result of rupture.

View and Analyzing and Discussing the Results of (Pre, Middle and Post) Tests for Measuring the Circumference of the Leg Muscle:

Table 3: Counting the Mean &standard deviation & Freedman’s value among the (Pre, Middle and post) tests for sample search for the injured people who suffer from the partial longitudinal rapture of the cartilage of the knee joint for counting the circumference of the leg muscle

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tests</th>
<th>Mean</th>
<th>SD</th>
<th>Counted Freedman’s value</th>
<th>Level of significance</th>
<th>Significance of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>counting the circumference of the leg muscle</td>
<td>Pre</td>
<td>32.220</td>
<td>3.090</td>
<td>20</td>
<td>0.000</td>
<td>Sig.</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>34.910</td>
<td>2.688</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>post</td>
<td>39.830</td>
<td>3.303</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The data in this table shows that the value of the mean for the primary test (32.220) in the standard deviation (3.090) and the value of the mean for the Middle test (34.910) and in the standard deviation (2.688), While the value of the mean for the post test (39.830) in the standard deviation (3.303),Comparing with the Middle test and with the use of Freedman’s test to realize the Incorporeal difference, it appeared that there are Incorporeal difference with statistical indication among the (pri, Middle and post) tests for the post tests. You can see the counted Freedman’s value (20) as compared with the level of significance (0.000). This shows that there is a difference for the post test.

The main reason behind that is the circumference of the leg muscle was weak at the beginning of the rehabilitation program. However the use of the physical exercises and the therapeutic devices result in improvement in shaping a strong leg muscle which
means that therapeutic devices affects positively in counting the circumference of the leg muscle.\textsuperscript{8}

Mou’ad Al Ta’ee assures that (the training process leads to changes in the organic devices for the athletes. In each training, they suffer from slight changes. This change is positive which means improvement in the efficiency of the functional devices.\textsuperscript{9}

\textbf{Conclusions}

By discussing the findings of the researcher using statistical methods, the following conclusions were drawn:

1. The exercise exercises to inflate and build a strong muscle for the thigh muscles as a result of rehabilitation and the use of resistors of different weights.

2. The therapeutic exercises have a positive effect on the strength of the perimeter of the quadriceps muscle.

3. Graduation in rehabilitation through the therapeutic exercises of the research sample led to good results than before the injury for the muscles working on the knee joint.

\textbf{Ethical Clearance:} Taken from Ministry of Education committee

\textbf{Source of Funding:} Self

\textbf{Conflict of Interest:} None

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Study of Effectiveness Taburia Programs (Multi Gizimicro Substances) at Children Ages 6-24 Months in South Sulawesi Province

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ABSTRACT

This study aims to look at the effectiveness of the taburia program on growth and development in children aged 6-24 months in South Sulawesi. The design of the study is an evaluation study, which is to evaluate the administration of powder taburia, and its impact on nutritional status and the growth and development of children aged 6-24 months. This research was conducted in Makassar, Pangkep and Jeneponto. Samples were children aged 6–24 months who were selected by 3 Public Health Center and then 3 villages with a sample of 675 children, but until the end of the study the remaining 398 children. The results of the study found that the overall taburia program was effective against changes in BB and PB significantly. For changes in z-score BB/U is not significant while PB/U is significant. For the average BB baby changes in Jeneponto that are obedient to those who do not comply, Pangkep and Makassar are better compliant. As for changes in the PB/U z-score, the three regions that are not compliant change their body length better. For overall gross motor development, there are more people who do not comply with consuming taburia. For Makassar, only 5 children were obedient and normal motoric development and 36 children did not comply. Pangkep whose motor development is normal and obedient to 25 children, there are 2 children who obey and motor development above normal. Different from Jeneponto, none of them were normal who obeyed, while those who did not comply with normal motoric development were 95 children, some even had late development there were 12 children, although there was also one child above normal motor development. In conclusion, the program of providing taburia is effective against the increase and development of the bodies of children aged 6-24 months. It is recommended that giving taburia be recommended because it has an influence on a better line of growth and development.

Keywords: Taburia, Growth, Rough Motor Development, Children, Multi Gizimicro

Introduction

In Indonesia, many infants and children aged 6-24 months have inadequate nutritional status, which is reflected in the high prevalence of underweight and stunting. One indicator of low nutritional status is the high prevalence of malnutrition. The results of survey Riskesdas show that there was an improvement in nutritional status aged 6-24 months from 2005 to 2007, from 9.7% to 5.4%. During the same period, the prevalence of malnutrition decreased from 14.8% to 13.0%.1[2]

At present, the national prevalence of malnutrition and malnutrition (6-24 months) has been reduced according to the target of the Medium Term Development Plan (RPJM) to achieve nutrition improvement programs (20%) and the Millennium Development Goals (MDGs) target in 2015 (18.5 %) has been achieved in 2007, although it has not been evenly distributed throughout Indonesia.
Several programs have been carried out to tackle nutritional disasters in Indonesia. Among the MP-ASI giving program in the early 2000s, although it has not provided maximum results because of the problems faced in the field. [3][4] To overcome various problems in MP-ASI, multi micronutrients have been given the name Taburia. Before that, the Indonesian Ministry of Health at that time had carried out a study on the efficacy of Taburia and 2 other types of Taburia (Anuka and Vitalita) to assess the effect of the amount of each Taburia in treating anemia in children.

A validation study on the efficacy of taburia studies showing that, although it did not significantly affect growth, it had a significant impact on infant motor development. [5][6] The results of this study also showed an increase in mean Hb levels in the intervention group (0.21 ± 1.24 mg/dl). Research results in Indonesia reinforce that the effect of taburia vitalita does not have a significant further impact on children’s growth.[7] However, improvements in reducing the impact of anemia have shown positive results such as the study in North Jakarta, where most children under five (95%) want to consume Taburia so that the impact on toddlers suffering from anemia drops by 37.6% (from 62.3% to 24.7%).[9]

Nutritional problems, besides being related to iron deficiency, are also related to the fact of food availability in the household. Besides being aggravated by family nutrition care that has not supported such practices as exclusive breastfeeding is still very low (7.8%), weighing baduta in Posyandu is still low (43%), consumption of iodized salt with sufficient quality, is still lacking (73%), and the family eats a wide variety.[2]

In the first month (T0) the number of samples is still the same with a total of 675 samples. In the second month (T1) to the fifth month (T4) there was a reduction in the number of samples. This happens, because exclude is aged (> 24 months), is absent on the grounds of returning home or is not present at the time of data collection, moving, and dying. The final sample number was 398 samples. For samples of gross motor development, based on the measured melastone scale measurements were children aged 6-18 months, so that those who met the criteria were 484 children. At the end of the study there were 274 remaining samples.

Weighing the weight using a portable calibrated scale of 0.1 kg and measuring body length using microtox. While for measuring motor development using the Milestone Motor Development scale. The results of these measurements provide clues as to whether or not, developmental growth is more or less normal.

Results

The results of this study were carried out in South Sulawesi Province, the results of data analysis were presented in table form accompanied by the following narrative.

Table 1: Distribution of Baduta according to Characteristics of Parent Education, Age Group and Gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mother’s Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not completed in primary school</td>
<td>57</td>
<td>8.5</td>
</tr>
<tr>
<td>Finish elementary/middle school</td>
<td>446</td>
<td>66.1</td>
</tr>
<tr>
<td>Finish high school/university</td>
<td>172</td>
<td>25.4</td>
</tr>
<tr>
<td>Total</td>
<td>675</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Father’s Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not completed in primary school</td>
<td>73</td>
<td>10.8</td>
</tr>
<tr>
<td>Finish elementary/middle school</td>
<td>378</td>
<td>56.0</td>
</tr>
<tr>
<td>Finish high school/PT</td>
<td>224</td>
<td>33.2</td>
</tr>
<tr>
<td>Total</td>
<td>675</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Age Group (Months)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-11</td>
<td>202</td>
<td>29.9</td>
</tr>
<tr>
<td>12-24</td>
<td>473</td>
<td>70.1</td>
</tr>
<tr>
<td>Total</td>
<td>675</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man</td>
<td>325</td>
<td>48.1</td>
</tr>
<tr>
<td>Woman</td>
<td>350</td>
<td>51.9</td>
</tr>
<tr>
<td>Total</td>
<td>675</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Method

This study is an evaluation study, which assesses the administration of powder taburia, and its impact on nutritional status and the growth and development of children aged 6-24 months. Giving taburia powder containing 15 kinds of vitamins and minerals is carried out for 4 months (120 days), every two days, according to the duration of the PMT program.

This research was conducted in South Sulawesi (province of the NICE program). The sample of this study was children aged 6-24 months who were enrolled in the research program giving taburia. Regional areas include the cities of Makassar, Pangkep and Jeneponto. Each region selected 3 health centers using purposive sampling, based on the distance from the center of the capital (near, medium and far). In each puskesmas 3 villages were selected using Probability Proportional to Size. Followed by the selection of families with socio-economic relative, the same as using Systematic Random Sampling. The number of samples is 3 cities/districts x 3 health center x 3 villages x 25 children (6–24 months) = 675 children.

Several programs have been carried out to tackle nutritional disasters in Indonesia. Among the MP-ASI giving program in the early 2000s, although it has not provided maximum results because of the problems faced in the field. [3][4] To overcome various problems in MP-ASI, multi micronutrients have been given the name Taburia. Before that, the Indonesian Ministry of Health at that time had carried out a study on the efficacy of Taburia and 2 other types of Taburia (Anuka and Vitalita) to assess the effect of the amount of each Taburia in treating anemia in children.

A validation study on the efficacy of taburia studies showing that, although it did not significantly affect growth, it had a significant impact on infant motor development. [5][6] The results of this study also showed an increase in mean Hb levels in the intervention group (0.21 ± 1.24 mg/dl). Research results in Indonesia reinforce that the effect of taburia vitalita does not have a significant further impact on children’s growth.[7] However, improvements in reducing the impact of anemia have shown positive results such as the study in North Jakarta, where most children under five (95%) want to consume Taburia so that the impact on toddlers suffering from anemia drops by 37.6% (from 62.3% to 24.7%).[9]

Nutritional problems, besides being related to iron deficiency, are also related to the fact of food availability in the household. Besides being aggravated by family nutrition care that has not supported such practices as exclusive breastfeeding is still very low (7.8%), weighing baduta in Posyandu is still low (43%), consumption of iodized salt with sufficient quality, is still lacking (73%), and the family eats a wide variety.[2]

In the first month (T0) the number of samples is still the same with a total of 675 samples. In the second month (T1) to the fifth month (T4) there was a reduction in the number of samples. This happens, because exclude is aged (> 24 months), is absent on the grounds of returning home or is not present at the time of data collection, moving, and dying. The final sample number was 398 samples. For samples of gross motor development, based on the measured melastone scale measurements were children aged 6-18 months, so that those who met the criteria were 484 children. At the end of the study there were 274 remaining samples.

Weighing the weight using a portable calibrated scale of 0.1 kg and measuring body length using microtox. While for measuring motor development using the Milestone Motor Development scale. The results of these measurements provide clues as to whether or not, developmental growth is more or less normal.

Results

The results of this study were carried out in South Sulawesi Province, the results of data analysis were presented in table form accompanied by the following narrative.

Table 1: Distribution of Baduta according to Characteristics of Parent Education, Age Group and Gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mother’s Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not completed in primary school</td>
<td>57</td>
<td>8.5</td>
</tr>
<tr>
<td>Finish elementary/middle school</td>
<td>446</td>
<td>66.1</td>
</tr>
<tr>
<td>Finish high school/university</td>
<td>172</td>
<td>25.4</td>
</tr>
<tr>
<td>Total</td>
<td>675</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Father’s Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not completed in primary school</td>
<td>73</td>
<td>10.8</td>
</tr>
<tr>
<td>Finish elementary/middle school</td>
<td>378</td>
<td>56.0</td>
</tr>
<tr>
<td>Finish high school/PT</td>
<td>224</td>
<td>33.2</td>
</tr>
<tr>
<td>Total</td>
<td>675</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Age Group (Months)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-11</td>
<td>202</td>
<td>29.9</td>
</tr>
<tr>
<td>12-24</td>
<td>473</td>
<td>70.1</td>
</tr>
<tr>
<td>Total</td>
<td>675</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man</td>
<td>325</td>
<td>48.1</td>
</tr>
<tr>
<td>Woman</td>
<td>350</td>
<td>51.9</td>
</tr>
<tr>
<td>Total</td>
<td>675</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Child Nutritional Status and Compliance Consume Taburia

Table 2: Distribution of changes in BB, Z BB/U score and rate of BB change in infants under age 6-24 months for 4 months in the coverage area of the Taburia administration program

<table>
<thead>
<tr>
<th>Variable</th>
<th>Compliance with Taburia Consumption</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obey</td>
<td>Not Obey</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Change of BB (T0-T4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pangkep (n = 137)</td>
<td>0.89</td>
<td>± 0.58</td>
</tr>
<tr>
<td>Makassar (n = 90)</td>
<td>0.69</td>
<td>± 0.24</td>
</tr>
<tr>
<td>Jeneponto (n = 171)</td>
<td>0.98</td>
<td>± 0.56</td>
</tr>
<tr>
<td><strong>Total (n = 398)</strong></td>
<td>0.85</td>
<td>± 0.52</td>
</tr>
<tr>
<td>Change of z-skor BB/U (T0-T4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pangkep (n = 137)</td>
<td>0.15</td>
<td>± 1.09</td>
</tr>
<tr>
<td>Makassar (n = 90)</td>
<td>-0.06</td>
<td>± 0.50</td>
</tr>
<tr>
<td>Jeneponto (n = 171)</td>
<td>-0.59</td>
<td>± 0.79</td>
</tr>
<tr>
<td><strong>Total (n = 398)</strong></td>
<td>0.03</td>
<td>± 0.97</td>
</tr>
<tr>
<td>Increase rate of BB (T0-T4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pangkep (n = 137)</td>
<td>1.17</td>
<td>± 0.69</td>
</tr>
<tr>
<td>Makassar (n = 90)</td>
<td>0.89</td>
<td>± 0.35</td>
</tr>
<tr>
<td>Jeneponto (n = 171)</td>
<td>0.75</td>
<td>± 0.37</td>
</tr>
<tr>
<td><strong>Total (n = 398)</strong></td>
<td>1.06</td>
<td>± 0.61</td>
</tr>
</tbody>
</table>

*Independent t test

Table 3: Distribution of PB changes, Z PB/U scores, and rate of change in PB underfives aged 6-24 months in the coverage area of the Taburia administration program

<table>
<thead>
<tr>
<th>Variable</th>
<th>Compliance with Taburia Consumption</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obey</td>
<td>Not Obey</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Change of PB (T0-T4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pangkep (n = 137)</td>
<td>4.68</td>
<td>± 2.75</td>
</tr>
<tr>
<td>Makassar (n = 90)</td>
<td>3.57</td>
<td>± 1.40</td>
</tr>
<tr>
<td>Jeneponto (n = 171)</td>
<td>3.01</td>
<td>± 1.50</td>
</tr>
<tr>
<td><strong>Total (n = 398)</strong></td>
<td>4.26</td>
<td>± 2.46</td>
</tr>
<tr>
<td>Change of z-skor PB/U (T0-T4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pangkep (n = 137)</td>
<td>0.15</td>
<td>± 1.09</td>
</tr>
<tr>
<td>Makassar (n = 90)</td>
<td>-0.06</td>
<td>± 0.50</td>
</tr>
<tr>
<td>Jeneponto (n = 171)</td>
<td>-0.59</td>
<td>± 0.79</td>
</tr>
<tr>
<td><strong>Total (n =3 98)</strong></td>
<td>0.03</td>
<td>± 0.97</td>
</tr>
<tr>
<td>Increase Rate of PB (T0-T4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pangkep (n = 137)</td>
<td>1.17</td>
<td>± 0.69</td>
</tr>
<tr>
<td>Makassar (n = 90)</td>
<td>0.89</td>
<td>± 0.35</td>
</tr>
<tr>
<td>Jeneponto (n = 171)</td>
<td>0.75</td>
<td>± 0.37</td>
</tr>
<tr>
<td><strong>Total (n = 398)</strong></td>
<td>1.06</td>
<td>± 0.61</td>
</tr>
</tbody>
</table>

*Independent t test
Table 4: Relationship between compliance with gross motoric development in the coverage area of the Taburia administration program

<table>
<thead>
<tr>
<th>Compliance with Taburía Consumption</th>
<th>Motor Development Status (T0-T4)</th>
<th></th>
<th></th>
<th></th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Late</td>
<td>Normal</td>
<td>Above Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Makassar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obey</td>
<td>0</td>
<td>0,0</td>
<td>5</td>
<td>100,0</td>
<td>0</td>
</tr>
<tr>
<td>Not Obey</td>
<td>2</td>
<td>5,3</td>
<td>36</td>
<td>94,7</td>
<td>0</td>
</tr>
<tr>
<td>Pangkep</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obey</td>
<td>0</td>
<td>0,0</td>
<td>25</td>
<td>92,6</td>
<td>2</td>
</tr>
<tr>
<td>Not Obey</td>
<td>0</td>
<td>0,0</td>
<td>68</td>
<td>100,0</td>
<td>0</td>
</tr>
<tr>
<td>Jeneponto</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obey</td>
<td>0</td>
<td>0,0</td>
<td>0</td>
<td>0,0</td>
<td>0</td>
</tr>
<tr>
<td>Not Obey</td>
<td>12</td>
<td>11,1</td>
<td>95</td>
<td>88,0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obey</td>
<td>0</td>
<td>0,0</td>
<td>30</td>
<td>93,8</td>
<td>2</td>
</tr>
<tr>
<td>Not Obey</td>
<td>14</td>
<td>6,5</td>
<td>199</td>
<td>93,0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Chi-Square

Discussion

The diet of infants and children in developing countries, especially in Indonesia, especially in rural areas, has not been able to fulfill the nutrients needed, especially at the age of 6-24 months which at this age there is very rapid physical and psychological growth and development. Therefore, to meet needs that cannot be met from daily food intake can be done by supplementing certain nutrients needed, one of which is Taburía.

Given that in this study did not have control, one of the things that could be used as a substitute for control was the existence of a variable of compliance in this study. By using the parameters of weight gain each month it appears that the changes that occur are very small. The average increase in body weight measured is only around 1% every month. The results of this study are in line with the research in Indonesia, which shows that, sprinkle vitalita which contains 14 vitamins and minerals does not have a significant further impact on children’s growth.[7]

However, in terms of quantity, it can be seen that baduta who adhere to consuming Taburía in this study have better weight gain and better motor development compared to those who do not adhere to consuming Taburía.

Compliance with Taburía Consumption: Compliance with health programs is behavior that can be observed and can be directly measured. Commitment or attachment to a program is called adherence, which may be eternal. Both compliance and loyalty refer to the ability to maintain programs related to health promotion.

Interventions in this study used micronutrients in the form of Taburía. Provision of small amounts of micronutrients has been proven to have a great impact. Therefore, determining the level of compliance for consumption of Taburía is attempted not to use the cut-off point that is too high. For better data variations, use a 60% cut off point.[8],[9]

Nutritional Substance and Nutritional Status:
Providing nutritious food in sufficient quantities at the time of year is a matter that needs serious attention so that children do not fall into malnutrition. Especially in that period weaning occurs, namely the transition between breastfeeding and adult food as a source of energy and main nutrients. Many children experience micronutrient deficiencies during their growth period. A study conducted in Indonesia, Peru, South Africa and Vietnam shows that children’s growth is disrupted due to lack of micronutrients.[10],[11],[12],[13]

After a two-year-old child has enough nutrients, both the energy and protein sufficiency must be met from daily food. As is known, after a child is 6 months old, breastfeeding alone is not sufficient for the child.[14]
One of the things that allegedly contributed to the slow growth of baduta in this study was the low intake of macro nutrients through insufficient food. Does not meet the recommended nutritional adequacy rate. In addition to protein, the intake of other macro nutrients consumed does not meet the recommended nutritional standards. While for micronutrients only the intake of vitamin A, vitamin D and vitamin B12 are on average that meet AKG standards.

Children who get food intake that is less in quantity and or quality (nutritional value) will affect their growth and development. One result of lack of food intake is the occurrence of deficiencies (deficiencies) of micronutrients both vitamins and minerals.[12]

In this study one of the most important minerals in growth, namely zinc, was found to be very low intake, on average only 40%. Zinc (Zn) is an essential nutrient and has received considerable attention in various recent studies because of its role in the human body.[9] Zinc plays a role in the operation of more than 10 types of enzymes. Acts in the synthesis of Adenosine Dinukleoside (DNA) and Ribonucleoside Adenosine (RNA), and protein. So if zinc deficiency occurs it can inhibit cell division, tissue growth and repair.[15]

In this study, Fe intake was also less than 50% of AKG. Iron (Fe) is a micronutrient that is essential in producing hemoglobin which functions in transporting oxygen from the lungs to body tissues, transporting electrons in cells, and in synthesizing iron-containing enzymes needed to use oxygen while producing cellular energy.[13],[15],[16] Research on taburia as an alternative to adding micronutrients has finally encountered obstacles if macro nutrient intake is deficient.

Ethical Clearance: The study was approved by the institutional ethical board of the Universitas Muslim Indonesia.

References


The Role of Dexamethasone in Reducing Nausea and Vomiting after Laparoscopic Cholecystectomy

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¹Department of General Surgery, Almahaweel General Hospital, Iraq; ²Collage of Medicine, AL-Nahrain University, Iraq; ³Clinical Pharmacist, Baghdad Medical City, Iraq

ABSTRACT

Objective: To investigate the efficiency of single dose of (dexamethasone 4mg) intravenously in reduction of postoperative nausea and vomiting, and compared it to metoclopramide.

Method: A prospective placebo controlled study involved total of (150) patients diagnosed clinically and radiologically as cholecystitis and admitted for elective laparoscopic cholecystectomy. Patients were randomly divided into three groups, each with 50 patients, the incidence of nausea and/or vomiting was recorded in three groups with in first 6 hours postoperative and then during the next eighteen hours of the first postoperative day.

Results: Nausea and vomiting significantly reduced in the group receiving dexamethasone on the day of operation

Conclusions: Dexamethasone (4mg) as single prophylactic dose is effective in the prevention of postoperative nausea and vomiting in laparoscopic cholecystectomy. Additionally dexamethasone is more effective than metoclopramide in reducing postoperative nausea and vomiting following laparoscopic cholecystectomy.

Keywords: dexamethasone, postoperative, nausea, vomiting, prevention

Introduction

Postoperative nausea and vomiting (PONV) are the most common symptoms affecting patients after surgery under general anesthesia, with an incidence of approximately of 30%¹. The true incidence of PONV is difficult to determine because of the lack of a single stimulus of onset as well as the range of possible etiologies (medical, surgical, and patient and anesthesia associated). In the absence of antiemetic treatment, the incidence of PONV is estimated to be 25% to 30% for all surgical interventions and patient populations². However, the incidence rate of PONV after laparoscopic cholecystectomy (LC) is higher than that after other types of surgery³.

A rate of 46% to 75% has been reported for patients who did not receive antiemetic treatment after LC. The consequences of PONV can increase anxiety for the future of other surgical procedures, increased recovery time and hospital stay, and in severe cases, aspiration pneumonia, bleeding, metabolic alkalosis and incisional hernia⁴.

Dexamethasone was first reported in 1981, as an effective antiemetic in patient receiving chemotherapy, since then, it has been widely applied in the prevention nausea and vomiting before chemotherapy. Dexamethasone is a potent synthetic member of the glucocorticoid class of steroid drugs Dexamethasone acts as an anti-inflammatory and immunosuppressant. Dexamethasone is 20 to 30 times more potent than the naturally occurring hormonal cortisol. The mechanism of antiemetic action of corticosteroid is not fully understood. The theories about the mechanism include: It is acting by central inhibition of prostaglandin synthesis, inhibition the release of endogenous opioid, changing the permeability of blood brain barrier to serum protein. It is acting antiemetic action by peripheral mechanism, as anti-inflammatory action which leads to reduce tissue

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inflammation in the site of surgery and lead to reduce the ascending parasympathetic impulse (vagus) to vomiting center. The most adverse effects include impairing glucose metabolism, delayed wound healing, myopathy, neuritis, glaucoma and adrenal suppression.5,6

Among the anti-emetic currently widely used low cost prescribed for (PONV) Metoclopramide is dopamine receptor antagonist. Metoclopramide is increasing upper gastrointestinal motility and lower esophageal sphincter tone, with half-life (5-6) hours. Metoclopramide have side effects included sedation, restlessness, dizziness and extrapyramidal symptoms (dystonic reaction in 25% of young adult)7. The current work aimed to investigate the efficiency of single dose of (dexamethasone 4mg) IV in reduction of PONV and to point out the possible undesired side effect included of this treatment, and to compare (dexamethasone 4mg) with an antiemetic drug (metoclopramide 10 mg).

**Method**

**Setting:** This prospective placebo controlled study involved total of (150) patients who were diagnosed clinically and radiologically as cases of cholecystitis and admitted for elective LC in the department of surgery Al-Iammad Al-Kadhumain Medical City/ Baghdad/Iraq, during the period from October 2015 to November 2016. All patients had an American society of anesthesiologists (ASA) physical status I or II. Patients with history of motion sickness, pregnancy, women who were menstruation, gastrointestinal disorders, laparoscopy conversion to open cholecystectomy, allergy to dexamethasone or metoclopramide, those who received antiemetic drugs within 24 hours before surgery and diabetic patient were excluded from the study.

**Data Collection:** Data including age, sex, smoking status, ASA and blood pressures were obtained by direct interview or from the patient’s record.

**Study Design:** Patients were randomly divided into three groups, each with 50 patients: Group I: given (dexamethasone 4mg) intravenously at the time of induction of general anesthesia (Dexa-treated). Group II: given (metoclopramide 10mg) intravenously at the time of induction (Metoc-treated). Group III: given (normal saline 2ml) intravenously at the time of induction (Saline-treated).

The study drugs were prepared by blinded nurse anesthetists in identical 2 mL three syringes. The drugs were given immediately after the induction.

**Laboratory Analysis:** Approximately 4 mL of venous blood were obtained from each patient in two times, one at anesthesia induction and the other 4 hours after treatment with the different medications. Serum was obtained from each blood sample after it was undergone clotting and proper centrifugation. Sera were kept at (20) C until be used for measuring serum levels of glucose.

**Anesthesia Induction:** All patients received single dose of (cefotaxime 1g) at the time of induction, the perioperative fluid used dextrose water 5% for all patients. The anesthetic regimen was similar to all patients. Sedation by fentanyl (10mcg/kg/dose), induction by thiopental sodium (3-4mg/kg), maintenance by halothane (0.5% to 3%), relaxation by pancuronium (0.1 mg/kg/hr) and reversal by neostigmine (0.03 mg/kg). The operation was done by reverse Trendelenburg position, with standard 4 ports technique. The pneumoperitoneum was maintained at (10-14) mmHg. The duration of operation calculated from induction of anesthesia to extubating, and then patients were discharged to surgical ward.

The postoperative analgesia was given (paracetamol 1g) intravenously with intravenous fluid and antibiotic and nil by mouth. The incidence of nausea and/or vomiting was recorded in tree groups with in first 6 hours postoperative and then during the next eighteen hours of the first postoperative day.

**Vomiting Severity:** The number of vomiting attacks was classified into:
- Grade 0: if the number (zero)
- Grade 1: if the number (1-4)
- Grade 2: if the number > (4).

When patients developed repeated vomiting ≥ 4 were give (ondansetron 4mg) by intravenous injection as rescue anti-emetic drug 8(14-19).

**Recovery Period:** Early recovery was assessed by the Aldrete’s scoring system. The Aldrete’s scoring system is a commonly used scale for determining when patients can be safely discharged from the post-anesthesia care unit (PACU) to either the postsurgical ward or to the second stage (Phase II) recovery area.9
Definitions

Short-term Complications: The end point of this study is recording short term complication within 10 days post operation which is the last visit for most patients.

The complete response was defined no (PONV) and no antiemetic medication during the first 24 hours postoperative.

Statistical Analysis

Statistical package for social sciences (SPSS 22.0) software was used for all statistical analysis. Data were expressed as mean ± standard deviation (SD). Chi-square was used to compare categorical values, while analysis of variance was used to compare continuous valued. A P-value ≤ 0.05 was considered statistically significant.

Result

There is no significant difference in age, gender, smoking, ASA class, SBP, duration of operation, and post site infection (complication). Additionally; both dexamethasone and metoclopramide treated patients had 50% increased FBS from baseline while placebo had 29.4% increased FBS from baseline, as illustrated in table 1.

Table 1: Assessment of Demographic and Clinical Characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Dexe</th>
<th>Metoc</th>
<th>Placebo</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>Age (years), mean ± SD</td>
<td>45 ± 2.3</td>
<td>43 ± 5.5</td>
<td>44 ± 4.2</td>
<td>0.063</td>
</tr>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.364</td>
</tr>
<tr>
<td>Female</td>
<td>43 (86.0%)</td>
<td>45 (90.0%)</td>
<td>40 (80.0%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7 (14.0%)</td>
<td>5 (10.0%)</td>
<td>10 (20.0%)</td>
<td></td>
</tr>
<tr>
<td>Smoking, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.675</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>47 (94.0%)</td>
<td>47 (94.0%)</td>
<td>45 (90.0%)</td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td>3 (6.0%)</td>
<td>3 (6.0%)</td>
<td>5 (10.0%)</td>
<td></td>
</tr>
<tr>
<td>ASA class, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.873</td>
</tr>
<tr>
<td>I</td>
<td>40 (80.0%)</td>
<td>41 (82.0%)</td>
<td>42 (84.0%)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>10 (20.0%)</td>
<td>9 (18.0%)</td>
<td>8 (16.0%)</td>
<td></td>
</tr>
<tr>
<td>SBP (mmHg), mean ± SD</td>
<td>77.41 ± 12.2</td>
<td>78.9 ± 11.6</td>
<td>77.1 ± 12.5</td>
<td>0.730</td>
</tr>
<tr>
<td>Duration of operation, mean ± SD</td>
<td>56 ± 7.12</td>
<td>58 ± 8.28</td>
<td>60 ± 10.81</td>
<td>0.082</td>
</tr>
<tr>
<td>Complications, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.948</td>
</tr>
<tr>
<td>Port site infection</td>
<td>7 (14.0%)</td>
<td>8 (16.0%)</td>
<td>7 (14.0%)</td>
<td></td>
</tr>
<tr>
<td>Fasting blood glucose, mean ± SD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>102 ± 18.2</td>
<td>98 ± 22.14</td>
<td>109 ± 24.64</td>
<td>0.041 [S]</td>
</tr>
<tr>
<td>After 4 hours</td>
<td>159 ± 43.14</td>
<td>147 ± 40.28</td>
<td>141 ± 23.13</td>
<td>0.046 [S]</td>
</tr>
<tr>
<td>Change (%)</td>
<td>55.9%</td>
<td>50.0%</td>
<td>29.4%</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 2: Assessment of Nausea and Vomiting According to Treatment

<table>
<thead>
<tr>
<th>Variables</th>
<th>Dexe</th>
<th>Metoc</th>
<th>Placebo</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>Nausea and vomiting, n (%)</td>
<td>11 (22.0%)</td>
<td>22 (44.0%)</td>
<td>34 (68.0%)</td>
<td>&lt;0.001 [S]</td>
</tr>
<tr>
<td>Nausea, n (%)</td>
<td>6 (12.0%)</td>
<td>14 (28.0%)</td>
<td>22 (44.0%)</td>
<td>0.002 [S]</td>
</tr>
<tr>
<td>Vomiting, n (%)</td>
<td>5 (10.0%)</td>
<td>8 (16.0%)</td>
<td>12 (24.0%)</td>
<td>0.169</td>
</tr>
<tr>
<td>Vomiting grade, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Grade I</td>
<td>4 (80.0%)</td>
<td>5 (62.5%)</td>
<td>7 (58.3%)</td>
<td></td>
</tr>
<tr>
<td>Grade II</td>
<td>1 (20.0%)</td>
<td>3 (37.5%)</td>
<td>5 (41.7%)</td>
<td></td>
</tr>
</tbody>
</table>
Conted…

<table>
<thead>
<tr>
<th>Onset of vomiting, n (%)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Early onset</td>
<td>3 (60.0%)</td>
<td>4 (50.0%)</td>
<td>5 (41.7%)</td>
<td>NA</td>
</tr>
<tr>
<td>Late onset</td>
<td>2 (40.0%)</td>
<td>4 (50.0%)</td>
<td>7 (58.3%)</td>
<td></td>
</tr>
<tr>
<td>Rescue antiemetic, n (%)</td>
<td>3 (6.0%)</td>
<td>5 (10.0%)</td>
<td>11 (22.0%)</td>
<td>0.044 [S]</td>
</tr>
</tbody>
</table>

**Discussion**

The current study revealed significant differences in the frequency of PONV among the three groups. Interestingly, the number of patients experiencing vomiting in Dexe-treated group is less than Metoc-treated group which in turn less than Placebo-treated group. Furthermore, most patients in Dexe-treated group showed grade 1 vomiting (1-4 episodes) compared to the other groups although the differences were not significant. These data indicate the efficiency of dexamethasone in single dose 4 mg IV in reduction of PONV. Somewhat similar results were obtained in many previous studies although with different doses and timing of injection. Kiu et al. suggested that 2.5 mg is the minimum dose of dexamethasone that was effective for preventing vomiting in women having a major gynecological surgery\(^1\), while Wang et al. showed that this dose should be 5 mg in thyroidectomy operations\(^1\). More recently, in a meta-analysis, they suggested that (8-16 mg) of the drug was more effective than (2-5mg) in reduction of PONV in patients undergoing LC. Higher dose of dexamethasone may be more effective than lower doses in prevention of PONV, but certainly they are not without side effects\(^1\).

High percentage (60%) of Dexe-treated group had early time onset vomiting compared to 50% in Metoc-treated group and 41.7% in Placebo-treated group. Although the differences were not significant this result indicates the delay action of dexamethasone. In the current study, dexamethasone was administered immediately after induction of anesthesia, and it is well-documented that it needs 1-2 hours after administration to diffuse across cell membranes\(^1\). Thus, it is possible that the optimal action of dexamethasone does not occur during the early 0-6 hours after anesthesia and 3 out of 5 patients in Dexe-treated group had vomiting during this period. When used dexamethasone at 90 minutes before surgery, Bisgaard et al\(^4\) found that 1/40 patients had vomiting during 0-6 PO hours. On the other hand Laiq et al\(^5\) used dexamethasone immediately prior to induction of anesthesia. They observed that 26% patients had vomiting during first 4 postoperative hours.

Administration of dexamethasone could be accompanied by many adverse effects such as increased blood glucose, delayed wound healing, increased risk of infection and adrenal suppression. The current study investigated the most likely occurring adverse effect of single dose of dexamethasone as there almost similar numbers of patients who were suffering from port site infection among the three groups after follow-up for 10 days. Of course, this effect cannot be attributed to dexamethasone because similar percentage of patients receiving metoclopramide or normal saline experienced the same infections within the same period\(^8\).

A number of studies indicated that blood glucose concentration (BGC) is increased after the administration of dexamethasone in a single dose with 4 or 8 mg\(^16\). In surgery, hyperglycemia should be one of the targets of perioperative management. That is because such cause may result in a large numbers of adverse physiological effects including hypovolemia, osmotic diuresis, high levels of circulating inflammatory cytokines and electrolytes and acid-base imbalance\(^17\).

Finally, dexamethasone is low cost drug and was found to prevent selective extrapyramidal and dysphoric effect associated with the traditional drugs such as metoclopramide. It also confers significant benefit in early as well as late stage pain\(^18\). Furthermore, Bagchi et al. reported that dexamethasone reduced the incidence of sore throat in patients having tracheal intubation. Therefore, dexamethasone may be the first drug of choice to prevent PONV\(^19\).

**Conclusions**

Dexamethasone (4mg) as single prophylactic dose is effective in the prevention of PONV in LC, and dexamethasone is more effective than metoclopramide in reducing PONV following LC, with no observed adverse effects.
Conflict of Interest: None

Ethical Clearance: Informed written consent was obtained from all the participants in the study, and the study and all its procedure were done in accordance with the Helsinki Declaration of 1975, as revised in 2000. The study was approved by the Iraqi Council for Medical Specializations in General Surgery.

Source of Funding: The study supported by authors only

REFERENCES


Objective: study the correlation of umbilical cord length with maternal and fetal parameters.

Materials and Method: A prospective observational study carried out on 100 pregnant women, with singleton pregnancy with gestational age between 37 completed weeks to 41 completed weeks. The umbilical cords and placentae had been examined after delivery for any abnormalities in shape of placenta, the site of umbilical cord insertion in it, abnormalities and the relation of these parameters to perinatal outcome. The study was carried out in department of Gynecology and Obstetrics at Baghdad Teaching Hospital for the period from 1st of December 2013 to the 1st of June 2014.

Results: The mean Umbilical cord length was 69.8 ± 22.6 cm. There was a significant correlation between non-reassuring fetal heart and long umbilical cord (P=0.03), other significant correlation was between low APGAR score (at 1st minute and 5th minutes) and long umbilical cord as compared to normal length umbilical cord (P= 0.019 and 0.041). There is a significant association with only low Apgar score at 1st and 5th minute (P=0.027, and 0.015) while other clinical and perinatal outcome parameters showed no significant correlation with umbilical cord length in all comparisons (p>0.05).

Conclusion: Abnormal cord length either short or long cord associated with low Apgar score at 1 and 5 minute as compared to the normal length of cord and the long cord associated with no-reassuring fetal heart more than short or normal cord.

Keywords: umbilical cord, fetal complications, Placental abnormalities, umbilical length, APGAR score

Introduction

The umbilical cord is a narrow tube-like structure that connects the developing fetus to the placenta. It delivers nutrients and oxygen to the fetus and removes the fetus waste products. Umbilical cord development begins around the 5th week of pregnancy from the yolk sac and allantois and replaces the yolk sac as the fetus’ source of nutrients. It becomes progressively longer until 28 weeks of pregnancy, reaching an average length of 35 to 70 cm. As the cord gets longer, it generally coils around itself.

The umbilical cord is the lifeline of the fetus, the position of the placental cord insertion, its shape and cord coiling are thought to be associated with perinatal outcome. It has been known for many years that the placental cord insertion, shape, size and pattern of cord coiling varies widely between pregnancies. In current obstetric and perinatal pathology practice, qualitative terms are generally used to describe the placenta There has been little attempt at quantifying or describing the relationship between measurements, including the distance of the umbilical cord insertion from the center of the placenta. The length of the umbilical cord has been proposed as a clinically useful marker of placental insufficiency. The current work aimed to study the correlation of umbilical cord length with fetal parameters including Apgar score at 1 minute and 5 minute, weight, NCU admission, non-reassuring fetal heart, intrauterine death, early neonatal death and its effect on mode of delivery.
Method

Study Design And Setting: A prospective observational study conducted in the Department of Obstetrics and Gynecology of Baghdad teaching hospital during the period from 1st December 2013 to 1st June 2014.

Total number of 100 pregnant women at gestational age of >37 weeks with singleton pregnancy admitted to labor room, with short cord regarded as <35cm, and long cord regarded as >70 cm.

Exclusion Criteria:
- Preterm deliveries (<37 weeks of gestation)
- Multiple pregnancy
- Babies delivered by elective caesarean section

Data Collection: Full history obtained from the cases including (history of the present pregnancy, past medical history, past obstetrical history, parity, date of last menstrual period and the gestational age confirmed by early ultrasound, history of previous operations, and drug history)

Examination for the pregnant women done including, general, medical, and obstetrical examination. Monitoring of the progress of labor including cervical dilatation, effacement, descend of the presenting part fetal heart monitoring using cardiotocography machine (CTG) and its changing with uterine contraction also monitored, mode of delivery, vaginal or cesarean, was also noted.

Active management of third stage of labor was done, examination of the delivered placenta for missing lobule and abnormal shape. Examination of umbilical cord done after delivery of the placenta for the following: The presence of any loop around neck, trunk, shoulder, Knots of cord (true or false), and Any cord abnormalities (cyst, hematoma, velamentous insertion, etc.).

After the delivery of fetus, cord was clamped at two places and cut in between. From the cut end up to fetal umbilicus and placental attachment umbilical cord, length was measured and added. It was measured with flexible tape measure in cm. Number of umbilical cord vessels was also studied in present series, by taking a small piece of the cord and examined under light microscope, the following parameters were recorded after the time of delivery:

1. Weight of the newborn: newborn was weighed after cutting the cord within half an hour of delivery.
2. Fetal outcome was studied by Apgar score at 1 and 5 min.
3. Neonatal mortality

Statistical Analysis

By using the statistical package for social sciences (SPSS) version 20, IBM, US, 2011, data of all cases were entered and analyzed with appropriate statistical tests. Descriptive statistics were presented as mean, standard deviation, frequencies and proportions (%). Independent t test was used to compare means, chi square was used to compare frequencies (fishers exact tests was used alternatively). Level of significance of < 0.05 considered significant.

Results

Maternal age was 27.1 ± 6.8 years, with mean gestational age of 38.4 ± 1.9 weeks, the majority had Multiparous with 82% having vaginal deliveries, and the umbilical cord length was 69.8 ± 22.6 cm, as illustrated in table 1.

Table 1: Assessment of Maternal and Neonatal Characteristic

<table>
<thead>
<tr>
<th>Variables</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age (years), mean ± SD</td>
<td>27.1 ± 6.8</td>
</tr>
<tr>
<td>Gestational age (weeks), mean ± SD</td>
<td>38.4 ± 1.9</td>
</tr>
<tr>
<td>Birth weight (kg), mean ± SD</td>
<td>3.2 ± 0.6</td>
</tr>
<tr>
<td>Parity, n (%)</td>
<td></td>
</tr>
<tr>
<td>Nulliparous</td>
<td>33 (33%)</td>
</tr>
<tr>
<td>Multiparous</td>
<td>67 (67%)</td>
</tr>
<tr>
<td>Mode of delivery, n (%)</td>
<td></td>
</tr>
<tr>
<td>Caesarean</td>
<td>18 (18%)</td>
</tr>
<tr>
<td>Vaginal</td>
<td>82 (82%)</td>
</tr>
<tr>
<td>Umbilical cord length (cm), mean ± SD</td>
<td>69.8 ± 22.6</td>
</tr>
<tr>
<td>Short</td>
<td>13 (13%)</td>
</tr>
<tr>
<td>Normal</td>
<td>57 (57%)</td>
</tr>
<tr>
<td>Long</td>
<td>30 (30%)</td>
</tr>
</tbody>
</table>
Only APGAR score at 1 and 5 minutes was associated with abnormal umbilical cord length, as illustrated in table 2.

Table 2: Association between Maternal and Neonatal Characteristics with Cord Length

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cord length</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Short</td>
</tr>
<tr>
<td>Number</td>
<td>57</td>
<td>13</td>
</tr>
<tr>
<td><strong>Cord abnormalities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cord prolapse</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Nuchal Cord</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Pseudo knot</td>
<td>2 (3.5%)</td>
<td>2 (15.4%)</td>
</tr>
<tr>
<td>True knot</td>
<td>1 (1.8%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td><strong>Placental abnormalities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circumvallate placenta</td>
<td>2 (3.5%)</td>
<td>1 (7.7%)</td>
</tr>
<tr>
<td>Marginal placental cord insertion</td>
<td>6 (10.5%)</td>
<td>1 (7.7%)</td>
</tr>
<tr>
<td>Succenturiate lobe</td>
<td>0 (0.0%)</td>
<td>1 (7.7%)</td>
</tr>
<tr>
<td><strong>Maternal age, n (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 years</td>
<td>11 (19.3%)</td>
<td>3 (23.1%)</td>
</tr>
<tr>
<td>20 – 35 years</td>
<td>39 (68.4%)</td>
<td>7 (53.8%)</td>
</tr>
<tr>
<td>&gt;35 years</td>
<td>7 (12.3%)</td>
<td>3 (23.1%)</td>
</tr>
<tr>
<td>Nulliparity</td>
<td>23 (40.4%)</td>
<td>3 (23.1%)</td>
</tr>
<tr>
<td><strong>Perinatal complications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-reassuring fetal heart</td>
<td>3 (5.3%)</td>
<td>3 (23.1%)</td>
</tr>
<tr>
<td>Intrauterine fetal death</td>
<td>3 (5.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td><strong>Mode of delivery</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caesarean section</td>
<td>8 (14.0%)</td>
<td>5 (38.5%)</td>
</tr>
<tr>
<td>Vaginal</td>
<td>49 (86.0%)</td>
<td>8 (61.5%)</td>
</tr>
<tr>
<td><strong>Neonatal outcomes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>3.2 ± 0.58</td>
<td>3.01 ± 0.47</td>
</tr>
<tr>
<td>Apgar score &lt; 7 at 1 minute</td>
<td>38 (66.7%)</td>
<td>12 (92.3%)</td>
</tr>
<tr>
<td>Apgar score &lt; 7 at 5 minute</td>
<td>21 (36.8%)</td>
<td>9 (69.2%)</td>
</tr>
<tr>
<td>Early neonatal death</td>
<td>3 (5.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>NICU Admission</td>
<td>11 (19.3%)</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>

NA: not applicable, n: number, NICU: neonatal care unit

Discussion

In the current study the mean umbilical cord length was 69.8 ± 22.6 cm, the shorter cord was 25 cm in length and the longest one was 100 cm. These values reported in our study were consistent with most of the reported averages in the literatures; a mean length of 44.3 ± 9.2 and 47.04 ± 12.8 cm obtained by Gupta et al. and Abaidoo et al., respectively. A study in Nigeria was conducted by Mutihir and Pam indicated an average cord length of 52.9 ± 7.3 cm.

Although it is not fully understood what controls cord length, various authors correlate cord length with fetal activity and movement. It is suggested that sufficient space in the amniotic cavity for movement and the tensile force applied to the umbilical cord during fetal movements are two main factors that determine cord length. Cords of fetuses that have severely diminished motions are remarkably short, and twins have slightly shorter cords probably due to a reduced space for movement.
The prevalence of short cords found in the present study was 13% and the long umbilical cord was found in 30% of the cases, while other women had normal length cords. Although reference standards for cord length have been reported, variation exists in the definition of short cords, studies referred that short cord is less common\textsuperscript{10}. In studying correlation of umbilical cord length against cord abnormalities which had been reported in 17 cases (8 cases with Pseudoknot, 6 with nuchal cord, 2 with true knot and one case with cord prolapse) or as a correlate with placenta abnormalities which had been reported as Marginal placental cord insertion in 9 cases, Circumvallate placenta in 4 cases, Placental abruption in 4 cases and Succenturiate lobe in one case, both cord abnormalities or placental abnormalities didn’t show the statistically significant correlation with the cord length, i.e. no statistically significant differences in the incidence of these abnormalities when compared between the three categories of cord length (short, long and normal). In the pregnancies with long umbilical cords, the incidence of pregnancies with succenturiate lobes of placenta, multiple nuchal cords and true umbilical knots were significantly higher than those with normal umbilical cords. These findings agreed with Suzukia S and Fusea Y study\textsuperscript{11}, they could not found these abnormalities in relation with short or long umbilical cords, however, they reported the short umbilical cords seemed to contribute to the increased rate of emergency Cesarean delivery, while the long umbilical cords seemed to contribute to the increased rate of multiple nuchal cords and true knots\textsuperscript{11}.

Many studies suggested that long or short umbilical cords, are associated with a number of circumstances which can impact fetal life and have been associated with antepartum abnormalities and risk factors for complications of labor and delivery\textsuperscript{12, 13}. Our data showed that long cord associated with perinatal complications, Non-reassuring fetal heart was found in 23.1% of the cases with short cord and 23.3% of those with long cords compared to 5.3% of those with normal cords length, this indicated association between the abnormal cord length and these complications, however, the difference was statistically significant in cases with long cord and didn’t reach the statistical significance in those with short cords. Our findings are in agreement with that reported in 2004 by Krakowiak et al.\textsuperscript{13} they found out that infants with short umbilical cords were more likely to have low APGAR score, and be small for their gestational age and have more perinatal complication\textsuperscript{13}.

The present study showed that short and long cords were associated with low Apgar scores, vast majority of neonates with short cords (92.3%) and also of those with long cords (93.3%) had low Apgar score at 1 minute as compared to those with normal cords (66.7%). At 5 minute low Apgar score was still significantly more frequent in those with short cords (69.2%), and long cord (66.7%) cords as compared to those with normal cords (36.8%). Our findings were in agreement with other studies that reported short and long cords associated with increased risk for maternal labor and delivery complications and adverse fetal and infant outcomes in cases included fetal distress among term infants\textsuperscript{13}, in Suzukia S and Fusea Y study\textsuperscript{11} they concluded that the short or long umbilical cords may not be associated with the adverse perinatal outcomes in Japanese singleton pregnancies delivered at > 34 weeks’ gestation.

Our data, however, showed no significant correlation between cord length and each of maternal age, Parity, maternal complication, and mode of delivery, which consistent with the a Japanese study\textsuperscript{11} and an earlier study in Taiwan was conducted by Wu JF in 1996 they used multivariate analyses, and concluded that the umbilical cord length does not significantly correlate with either maternal age, gestational age, parity fetal outcome or intrauterine fetal well-being\textsuperscript{14}.

**Conclusion**

Abnormal cord length either short or long cord associated with low Apgar score at land 5 minute as compared to the normal length of cord and the long cord associated with non-reassuring fetal heart more than short or normal cord

**Conflict of Interest:** None

**Ethical Clearance:** Informed written consent was obtained from all the participants in the study, and the study and all its procedure were done in accordance with the Helsinki Declaration of 1975, as revised in 2000. The study was approved by department of Gynecology and Obstetrics at Baghdad Teaching Hospital.

**Source of Funding:** The work were supported by authors only
REFERENCES


Pre-Marital Clinical Test among Intending Couples in Baghdad: Clinical Findings Knowledge and Attitudes

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¹University of Baghdad, College of Science, Dept. Biology, Baghdad, Iraq, ²Mustansirya University, College of Science, Dept. Biology, Baghdad, Iraq

ABSTRACT

Pre-marital clinical tests are essential part of every national health system. They provide proper medical care early to prevent unnecessary stress and burden during marriage. This study was set to investigate the clinical findings as well as knowledge and attitude toward these tests among intending couples (n=244 couples, age mean 25.7 years ranged from 15 to 75 years) in Al-Yarmouk Hospital, Baghdad- Iraq, during September 2016- December 2017. The results showed that the Rh incompatibility ratio was relatively high when 17.5% (37/244) of the couples have different Rh blood groups (Rh-/Rh+). A significant number (9.43%) of Rh- females who were intending to marry from Rh+ blood-types partners was identified in the present study. The result of HIV, HBV, HCV and VDRL viral screening showed a significant number of the intending couples (13.73 % (67/488)) have serious viral infections. The awareness levels of the importance of premarital screening tests were 67% and 64.4 % in males and females respectively. In terms of knowing the complications of blood group incompatibility during/after pregnancy, a similar positive attitude was shown by males and females toward this concept (64.92% and 65.87% respectively).While the vast majority (67.82%), of the investigated individuals, from both genders, do not know what precaution should be taken if a mother’s blood is Rh negative. 70.3% of the marriages were between non-consanguineous couples.

Keywords: Clinical findings ; clinical test; attitudes; Knowledge

Introduction

In marriage, choosing of a spouse is usually a matter of no bounds. However, most of the intending couples come into this lifelong union (marriage) with insufficient knowledge regarding their intending partner’s health status. Many medical conditions, especially those affecting the offspring’s health, can be detected and dealt with before or during marriage. This could help to avoid or minimize some disappointing and frustrating lifelong commitments (health threat). It has been reported that an increasing number of children suffering of blood or genetically transmitted illness that lead to a major public health problem (¹).Thus premarital screening should be an integral part of every national health system.

Rh incompatibility (especially for Rh negative blood group mothers who are pregnant with Rh+ embryos), has been linked to several offspring’s heath problems including hemolytic disease, that cause severe anaemia and jaundice, brain damage, and heart failure. In addition, newborn fetes death can be caused by severe Rh incompatibility cases (²). Recent study have shown a significant association (P=0.002) between mothers’ blood Rh and having disabled children (³). Moreover, hyperbilirubinemia resulted from Rh blood incompatibility could cases chromic stress, a situation that leads to impair the central nervous system (CNS). This could result in dismal pregnancy outcome representing by the increase the occurrence of miscarriage and stillbirth. Cerebral palsy, paralysis of limbs, and intellectual disability in infants could be the consequence of the CNS damages caused by hyperbilirubinemia (⁴, ⁵). Accordingly, baby’s health is
significantly affected by the Rh factor and it is crucial to know such information early in pregnancy or even before that (6).

Beside blood incompatibility test, other health conditions should be considered for pre-marital testing. These include the blood screening for viral infections, such as HIV, HSB, HCV and VDRL, which are represent serious health threat for the intending couples and their expecting children (7). Other recommended pre-marital blood test such as CBC, a complete blood count, which provides an evaluation of overall health for those planning to get married. This test also assesses to detect a wide spectrum of diseases such as anemia, infection and leukaemia.

Based on the above reviewed information, continued efforts must be allocated to raise the community awareness level toward such key clinical tests that are set for the benefit of individuals who planning to get married to reduce the burden of genetic transmitted diseases and the number of children affected accordingly.

Considering the above mention health concerns, this study aimed to the assess awareness levels of marriage intending couples toward the importance of pre-marital clinical test. In addition to the investigation of factors that might affect peoples’ knowledge and attitude in this regard. Furthermore, the incidence of clinical conditions that could affect the couples and their offspring health, such as viral infection disease and Rhesus blood incompatibility, were also investigated. This would help to estimate how much effort and resources need to be allocated for the management of such serious viral infections and Rh incompatibility issues affecting intending couples.

Subjects and Method

This project was performed according to the agreement of the Research and Training Unit in the Iraqi Ministry of Health and Environment. The present project included to studies: 1) a cross sectional study conducted in the Karkh-Side of Bagdad, Iraq. In this study, the premarital clinical screening data of 244 intending couples (488 individuals), from September 2016 to December 2017, were collected and analysed in the Premarital Screen Centre in Al-Yarmuk Hospital-Baghdad, Iraq. The collected data included information regarding the screened individual’s gender, age, blood group, and the screening for serious viral infections (HBS, HCV, HIV, and VDRL). All of clinical tests were performed in the Al-Yarmuk Hospital Laboratories Department.

Beside the cross sectional study, 2) a survey was also conducted on 316 individuals (randomly selected) who were voluntary agreed to participate in the study. This part of the project was set to investigate intending couples’ knowledge, awareness and attitude regarding the pre-marital clinical screening. The survey was performed using prepared questioner for this purpose. The questioner requested details about the education level, age, gender in addition to other information in respect of knowing the important of premarital tests, partner’s blood group, and the consequence of Rh-incompatibility.

Results

Age Distribution of the Studied Group: The age mean of the studied couples group was 25.7 years (ranged from 15 to 75 years). Males’ mean was 28.12 (ranged from 16 to 75 years). While in the females age mean was 23.38 years (ranged from 15 to 64 years). It is obvious that females comes to marriage in earlier ages than males, especially in the age between 15-20 years when the number of females in this age higher than that for males by approximately four folds (97 to 28) in this age category (Figure 1). At the age range of 21-25 years, almost similar number of males and females were found in this group of indented couples (87 and 83 respectively). More than one third (34.84 % (170/488)) of the screened individual get married in this age group (21-25 years). However, only less than 5% of the individuals were above the age of 40 year among the intending couples (Figure1).

Figure 1: Age distribution of the intending couples studied group. Most of the females (Green columns) seem to get married in earlier ages (15-25 years) and 95.3% of the individuals in the intending couples get married before the age of 40 years.
Blood Groups Incompatibility: Regarding the Rhesus blood type, the result showed that 90.37% of the studied individuals have positive blood groups (Rh+). While 9.73% of them showed to have negative blood types (Rh-) (Figure 2).

![Figure 2: Rh+/Rh- blood types percentages of the studied intending couples. 9.63% of the screened individuals have Rh negative blood types](image)

Additionally, among the surveyed intending couples, the blood Rh incompatibility ratio was relatively high when 17.5% (37/244) of the couples have different Rh blood groups (Rh-/Rh+, figure 3).

![Figure 3: Blood groups compatibility frequency among the studied intending couples](image)

Interestingly a significant number (9.63%) of females with negative blood types (Rh-) were intending to marry from Rh+ blood types partners identified in this study (Figure 4). This finding is suggesting that a significant number of the survived female at the risk of Rh incompatibility. The prevalence of Rh- blood types was similar (9.84% (24/244)) between the investigated males and females in the present study.

![Figure 4: Rh blood types incompatibility among the studied intending couples](image)

Viral Infections among the Screened Intending Couples: The result of HIV, HBV, HCV and VDRL viral screening tests showed that a significant number of the intending couples (13.73% (67/488)) have serious viral infection (Table 1). 19.67% of the screened males shown to have viral infection. This means that approximately 20 persons every each 100 of the intending couple have serious viral infection.

The most frequent viral infection recorded in the screened males was HBV which follows by HCV (human immunodeficiency virus), HIV and VDRL ((9.42), (4.38), (2.05) and (0.82) respectively). A similar trend of viral infection frequency was observed in the screened females (HBV (3.69), HCV (2.87), HIV (0.82) and VDRL (0.41)). In both genders, HBV and HCV positive cases accounted for 85.07% (57/67) of the spotted viral infections among the screened intending couples.
Table 1: The frequency of viral infection among the screened couples

<table>
<thead>
<tr>
<th></th>
<th>HIV+ n(%)</th>
<th>HBV+ n(%)</th>
<th>HCV+ n(%)</th>
<th>VDRL+ n(%)</th>
<th>Total n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males (n = 244)</td>
<td>5(2.05)</td>
<td>23(9.42)</td>
<td>18(4.38)</td>
<td>2(0.82)</td>
<td>48(19.67)</td>
</tr>
<tr>
<td>Females (n = 244)</td>
<td>2(0.82)</td>
<td>9(3.69)</td>
<td>7(2.87)</td>
<td>1(0.42)</td>
<td>19(3.9)</td>
</tr>
<tr>
<td>Total (n = 488)</td>
<td>7(1.43)</td>
<td>32(6.56)</td>
<td>25(5.12)</td>
<td>3(0.61)</td>
<td>67(13.73)</td>
</tr>
</tbody>
</table>

HIV = human immunodeficiency virus; HBV= hepatitis B virus; HCV= hepatitis B virus; VDRL = a screening test for syphilis

Intending Couple’s Knowledge and Attitudes Toward the Important of Premarital Clinical Tests: Regarding the awareness levels toward the importance of premarital screening tests, the results showed that the number of males who known their blood types were slightly higher than females in the studied group (67% and 64.4 % respectively). In respect to knowing the blood group of the partner, both females and males have shown lower levels toward this investigated parameter (36.12% and 32.34% respectively, Table 2). In terms of knowing the complications of blood group incompatibility during/after pregnancy, similar of positive attitude was shown by males and females toward this concept (64.92% and 65.87% respectively, Table 2). While the vast majority (67.82%), of the investigated individuals, from both genders, do not know what precaution should be in Rh- incompatibility cases (Table 2).

Table 2: Distribution blood groups Knowledge by gender in present study

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Females (No. (%))</th>
<th>Males (No. (%))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Know their blood group</td>
<td>123(64.4)</td>
<td>68(35.6)</td>
</tr>
<tr>
<td>Know their partners blood group</td>
<td>69(36.12)</td>
<td>68(35.6)</td>
</tr>
<tr>
<td>Know the complications of blood group incompatibility during/after pregnancy</td>
<td>124(64.92)</td>
<td>67(35.08)</td>
</tr>
<tr>
<td>Know what precaution should be taken in Rh-incompatibility cases</td>
<td>57(29.84)</td>
<td>134(70.16)</td>
</tr>
</tbody>
</table>

Additionally, the present study has highlighted positive association between increase the number of people who knew their blood group with their education the level (Table3).

Table 3: The relation between education level and knowing blood type

<table>
<thead>
<tr>
<th>Education level</th>
<th>Know his/her blood group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Illiterate</td>
<td>9(53%)</td>
<td>8(47%)</td>
</tr>
<tr>
<td>Primary</td>
<td>5(36.3%)</td>
<td>13(72.22%)</td>
</tr>
<tr>
<td>Secondary</td>
<td>96(65.8%)</td>
<td>50(34.2%)</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>81(69.2%)</td>
<td>36(30%)</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>16(88.8%)</td>
<td>2(11.2%)</td>
</tr>
<tr>
<td>Total</td>
<td>207 (65.50%)</td>
<td>109 (34.50%)</td>
</tr>
</tbody>
</table>

Consanguineous Marriages Rate: The results also showed that 70.25% of the marriages were between non-consanguineous couples (between non blood-related individuals). While there was a relatively low percentage of consanguineous marriages recorded in this study (17.08% and 12.65% for 1st and 2nd relative degrees respectively.

Discussion

Pre-marital clinical tests are essential part of modern health systems to improve the quality of life and reduce the burden risk of genetically transmitted diseases. These clinical tests are important for the detection and prevention of genetic disorders and some infectious diseases. The present study was set to investigate the clinical findings as well as knowledge and attitudes toward these tests among intending couples in Baghdad-Iraq.

In respect the age mean of the studied marriage intending couples, our study results were comparable to those obtained by Hayawi and his colleagues, when they found that the female’s age mean was 23 years and for males was 27 years in a study conducted in three
health centres in Baghdad-Al-Russafa on 550 intending couples (8). In the present study, generally people plan to marry at early age when most of the studied couples (95.3%) plan or get married before the age of forty years and approximately one third of them get married at the age between 21-25 years.

The relatively high percentage of blood groups Rh incompatibility (9.84%) among the studied intending couples is of a great important since Rh- mothers will be at high risk of Rh incompatibility when they become pregnant with Rh+ foetus. In comparison to other local studies, our study recorded slightly higher Rh- blood groups distribution than Kurdistan, Al-Najaf and Baghdad-Al-Russafa studies (8.27%, 7.4% and 4.18 respectively) (8-10). Globally, the Rh blood groups distribution varies from region to another with very low frequency for Rh negative blood types (less than 1%) in the East Asia countries such as Philippines (11). While the highest percentage of Rh negative blood groups (up to 19%) was reported in some countries such as Briton (9).

Regarding to incidence of the screened viral infections, our study result is quite similar what reported in a recent study in Nigeria when 5.8% of marriage intending couples were positive for HIV, HBV and HCV infection (12). Consistence with Ogba’s and colleagues study, all the HIV positive individuals in our study were negative for HBV, HCV and VDRL viral screening test. The prevalence of HIV positive cases in this screen also seems relatively higher than other international study (1.43% vs. 1%) (13). In our study, the infection rate peaked at the age of 20-25 years old (26/67(38.81%)) and this might be influenced by the fact that most (34.84 %) of the intending couples within this age category. All of the spotted VDRL (syphilis) viral infections were within the age above 40 years old. The males were showed to have approximately three folds increase in the number of viral infections cases compare to the screened females (19.67% vs.3.9% respectively).

This high level of marriages between those who are not bloods-related couples in this study may reflect a new attitude in the Iraqi urban’s community; especially in Baghdad where study and work opportunities increase the chances of non-consanguineous marriages. The level of non-consanguineous marriages seemed higher than previously reported by Lafta (14) and Hamamy (15) (55.95% and 50% respectively).

Concerning the investigation of the awareness levels of the intending couples toward the importance of pre-marital clinical screening, the level of awareness in the present study is much higher than that reported by Nasim and colleagues in Pakistan, Karachi (1). However, the level of knowing the precaution should be taken if a mother’s blood is Rh negative and pregnant with Rh+ fetus was relatively low (32.18%). These results seem consistent with previously reported in local (8) and international studies (16).

**Conclusion**

Overall, the study highlighted the important of pre-marital clinical screenings as a key diagnostic and prevention measurements to improve the quality of life and avoid/minimize unexpected outcome of marriage.

**Ethical Clearance:** The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Source of Funding:** Self-funding

**REFERENCES**


The Risk Analysis of Environmental Health Due to Exposure of Benzo[a]pyrene in Fish Smoking Process (Benzo[a]pyrene Effect Study on Smoked Fish Industry Workers in Bandarharjo, Semarang)

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¹Graduate Program, Environmental Science, ²Environmental Science, School of Environmental Science, Universitas Indonesia, Jakarta, Indonesia

ABSTRACT

Smoked fish is one of popular fish processed products in Indonesia. While smoke is one of problems in smoked fish industry. Benzo[a]pyrene is resulted by incomplete combustion. IARC stipulates benzo[a]pyrene as 2A category which means cancer cause in animals and probably also in humans. Analysis of health risk in smoked fish industry workers is needed in order to minimize the health risk. The aim of this research is to predict the health risk due to exposure of benzo[a]pyrene through inhalation on smoked fish industry workers. The research design uses environmental health risk analysis. The concentration value of benzo[a]pyrene in the air on 5 spots is <0.002 ppm or <0.02 mg/m³. The non-carcinogenic intake value (CDI) is 5.322 x 10⁻⁴ – 4.103 x 10⁻³ (mg/kg/day). The non-carcinogenic risk value level is (RQ) 9.712 x 10⁻² – 6.669 x 10⁻¹. The carcinogenic health risk level is 7.070 x 10⁻⁴ – 5.451 x 10⁻³. The conclusion of this research is carcinogenic risk level (ECR) is >10⁻⁴ and non-carcinogenic health risk level is > 1, so the value of RQ and ECR is categorized as risky. The work pattern of smoked fish workers is 8-10 hours/day, for 7-46 years, exposure frequency is 317-353 days/year and the weight of the respondents is around 42-98.5 kg.

Keywords: Benzo[a]pyrene, smoked fish industry, health risk assessment

Introduction

Other than giving positive impact smoked fish industry also has negative impact⁵. Indoor air pollution does not only happen in factories and houses in the city but also happens a lot in villages that still rely on burning wood cooking⁴. One of indoor pollution causes is cooking activity⁴. The main sources of benzo[a]pyrene indoor are smoking, wood burning in the fireplace and wood stove⁴. Wood burning increases benzo[a]pyrene concentration indoor⁴. European Environmental Agency sets target the concentration is not more than 1 ng/m³. Study on health risk level on smoked fish industry workers is needed.

Methodology

This research uses quantitative approach and environmental health risk analysis method. This research has been done for 10 months since January- November 2018, which consists of preparation stage until data processing. This research took place in Smoked Fish Production Centre, in Bandarharjo, Indonesia. This smoked fish industry centre is chosen because the production process of smoked fish cause air pollution. The populations in this research are the air and smoked fish industry workers. Air population is the air around smoked fish industry centre Bandarharjo, Semarang.

The population of smoked fish industry workers is all workers in Bandarharjo smoked fish industry centre,
Semarang consists of 13 smoked fish industries with 63 workers. Air sampling uses the purposive sampling method by taking samples at 5 different points, which is the air around Bandarharjo smoked fish industry centre. Air samples were taken by Chemviro laboratory then analyzed by PT Petrolab Sevices. Sampling of smoked fish industry workers uses purposive sampling method, they are 26 smoked fish industry workers who are at least 17 years old and hold responsibility for smoking fish.

The problem solving process begins with the identification of hazards caused by the results of incomplete combustion of the smoked fish industry which potentially cause health risk. Subsequently, carry the exposure analysis and proceed with dose response analysis, and carry out risk characterization.

1. **Intake is known by using the following formula**\(^{(10)}\):

\[
\text{LADD} = \frac{C \times R 	imes f \times E \times D \times t_{avg}}{W \times t_{avg}}
\]

**Note:**
- LADD: Lifetime Average Daily Dose (carcinogen intake) mg/kg/day
- CDI: Chronic Daily Intake (non-carcinogen intake) mg/kg/day
- C: Risk agent concentration mg/m\(^3\) (air)
- R: Rate (intake rate) 20 m\(^3\)/day (air)
- t\(_E\): Daily exposure time (hour/day)
- f\(_E\): Exposure Frequency (day/year)
- D\(_t\): Exposure duration (year)
- W\(_b\): Weight (kg)
- t\(_{avg}\): Average time period, 30 years x 365 days/year (non-carcinogenic), 70 years x 365 days/year (carcinogen)

2. **Risk Characterization:** Risk characterization in risky populations is stated quantitatively by combining dose response analysis and exposure analysis. Its numerical value is used for health risk management. Risk is divided into two, non-carcinogenic risks (risk quotient) and carcinogenic risk (excess cancer risk). To find out the value of non carcinogenic risk, the equation used is\(^{(10)}\):

\[
\text{RQ} = \frac{\text{CDI}}{\text{RfC}}
\]

**Note:**
- RQ = Risk Quotient (non-carcinogenic health risk level)
- CDI = Non-carcinogenic intake mg/kg/day
- RfC = Reference concentration mg/kg/day

Health risk is confirmed exist and need to be controlled if RQ > 1. If RQ ≤ 1, risk does not need to be controlled but needs to be maintained so RQ numeric number does not exceed 1\(^{(10)}\).

In order to find out carcinogenic risk value, equation used is\(^{(10)}\):

\[
\text{ECR} = \text{CSF} \times \text{LADD}
\]

**Note:**
- ECR = Excess cancer risk (carcinogenic health risk level)
- LADD = Carcinogenic intake mg/kg/day
- CSF = Cancer Slope Factor (mg/kg/day)\(^{-1}\)

**Results**

**Benzo[a]pyrene Concentration:** Benzo[a]pyrene is resulted from incomplete combustion. In this research found that benzo[a]pyrene concentration in the air is < 0.002 ppm. Subsequently, data of benzo[a]pyrene that could be converted to mg/m\(^3\) is:

\[
\text{mg/m}^3 = \text{concentration (ppm)} \times \frac{\text{molecular weight of gas (L)}}{\text{ideal molar standard (L)}}
\]

\[
\text{mg/m}^3 = \frac{0.002 \times 252.316}{24.465} = 0.02
\]

With the ideal molar volume standard of gas at pressure of 1 atm is 24.465 (dm)\(^3\)/mol at 25°C temperature

**Table 1: Benzo[a]pyrene Concentration in The Air**

<table>
<thead>
<tr>
<th>Location</th>
<th>Benzo[a]pyrene concentration (mg/m(^3))</th>
<th>European Environmental Agency (EEA) (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot 1</td>
<td>&lt;0.02</td>
<td>1 x 10(^{-6}) mg/m(^3)</td>
</tr>
<tr>
<td>Spot 2</td>
<td>&lt;0.02</td>
<td>1 x 10(^{-6}) mg/m(^3)</td>
</tr>
<tr>
<td>Spot 3</td>
<td>&lt;0.02</td>
<td>1 x 10(^{-6}) mg/m(^3)</td>
</tr>
<tr>
<td>Spot 4</td>
<td>&lt;0.02</td>
<td>1 x 10(^{-6}) mg/m(^3)</td>
</tr>
<tr>
<td>Spot 5</td>
<td>&lt;0.02</td>
<td>1 x 10(^{-6}) mg/m(^3)</td>
</tr>
</tbody>
</table>
The concentration of benzo[a]pyrene obtained in the air in the fish smoking chamber <0.02 mg/m$^3$. The results from this laboratory cannot detect the concentration of benzo[a]pyrene <0.02 mg/m$^3$. The smoked fish workers in charge of fish smoking in 13 centres are 26 people consists of 5 men and 21 women. The age of smoked fish workers is around 30-71 years. With the most age range of 51-60 years 15 people and 40-50 years old 7 people. The data of the age of smoked fish workers is attached as follows in Table 2.

**Table 2: The Age of Smoked Fish Workers**

<table>
<thead>
<tr>
<th>Age range (year old)</th>
<th>Amount (people)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30</td>
<td>1</td>
</tr>
<tr>
<td>31-40</td>
<td>1</td>
</tr>
<tr>
<td>41-50</td>
<td>7</td>
</tr>
<tr>
<td>51-60</td>
<td>15</td>
</tr>
<tr>
<td>61-70</td>
<td>1</td>
</tr>
<tr>
<td>71-80</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
</tr>
</tbody>
</table>

Based on Table 2, it could be seen that most age range of the smoked fish workers is 51-60 years old. The data of smoked fish workers’ weight is attached as follows in Table 3.

**Table 3: The Weight of Smoked Fish Workers**

<table>
<thead>
<tr>
<th>Weight range (Kg)</th>
<th>Amount (people)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-50</td>
<td>4</td>
</tr>
<tr>
<td>50.1-60</td>
<td>10</td>
</tr>
<tr>
<td>60.1-70</td>
<td>8</td>
</tr>
<tr>
<td>70.1-80</td>
<td>2</td>
</tr>
<tr>
<td>80.1-90</td>
<td>1</td>
</tr>
<tr>
<td>90.1-100</td>
<td>1</td>
</tr>
</tbody>
</table>

Based on Table 3, it could be seen that most weight range is 50.1-60 kg. The data of daily exposure time, exposure frequency, and exposure duration is attached as follows in Table 4.

**Table 4: Daily exposure time, exposure frequency, and exposure duration**

<table>
<thead>
<tr>
<th>tE (hour/day)</th>
<th>fE (day/year)</th>
<th>Dt (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>8</td>
<td>317</td>
</tr>
<tr>
<td>Maximum</td>
<td>10</td>
<td>353</td>
</tr>
</tbody>
</table>

**Estimated Amount of Intake:** The estimated amount of respondent’s benzo[a]pyrene intake was calculated using benzo[a]pyrene concentration value in the air around the smoked fish industry, anthropometric data and patterns of activity of respondents. The calculation of lifetime average daily dose (carcinogen intake) mg/kg/day and chronic daily intake is attached as follows in Table 5.

**Table 5: The Value of CDI and LADD of Smoked Fish Workers**

<table>
<thead>
<tr>
<th>Respondent</th>
<th>CDI (mg/kg/day)</th>
<th>LADD (mg/kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>5.322 x 10^{-4}</td>
<td>2.281 x 10^{-4}</td>
</tr>
<tr>
<td>Maximum</td>
<td>4.103 x 10^{-3}</td>
<td>1.758 x 10^{-3}</td>
</tr>
</tbody>
</table>

**Health Risk Characterization:** Risk quotient (RQ) is calculated to find the level of non-carcinogenic effect. If the non-carcinogenic risk level obtained is RQ≤1, the risk level is declared safe, but if the value of RQ >1 then the risk level value is declared unsafe or can cause non-carcinogenic health risk. The RQ value data is attached as follows in Table 6.

**Table 6: Respondents’ Estimated Value of Non-Carcinogenic Health Risks of Smoked Fish Workers**

<table>
<thead>
<tr>
<th>RQ note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
</tbody>
</table>

Excess cancer risk is also called the level of carcinogenic health risk is the calculation of the value intake multiplied by the cancer slope factor. Carcinogenic risk level is calculated to find the level of carcinogenic health risk. The ECR value with a range of $10^{-6}$<ECR<$10^{-4}$ is declared safe or acceptable. If the value of ECR>10^{-4} then it means that the level of carcinogenic health risk is categorized as unsafe or unacceptable and can cause carcinogenic health risk. Furthermore, the ECR value data is attached in Table 7.

**Table 7: ECR Value of Smoked Fish Workers**

<table>
<thead>
<tr>
<th>ECR note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
</tbody>
</table>

Based on Table 7, minimum ECR value is $7.070 \times 10^{-4}$ and maximum ECR value is $5.451 \times 10^{-3}$. Based on calculation result, it is found that all respondents have value of ECR > $10^{-4}$. 
Discussion

Based on Table 1, the concentration of benzo[a]pyrene in the air around fish smoking industry obtained is <0.02 mg/m³. Results from this laboratory cannot detect the concentration of benzo[a]pyrene <0.02 mg/m³. The researchers assume the value of benzo[a]pyrene in the air is 0.02 mg/m³. The concentration of benzo[a]pyrene in the air compared to European Environmental Agency (EEA) standard could be categorized as unsafe(11). The activity of fish smoking industry is a source of air pollution originating from immovable sources(12). Source of benzo[a]pyrene in fish smoking industry comes from the smoking process(3),(4),(5),(6).

The age of smoked fish industry workers is 30-71 years old. With the most age range of 51-60 years, there are 15 people and 40-50 years old, 7 people. This is because the smoked fish industry is a business that runs from generation to generation, so usually workers still have kinship with industrial owners or continue family business. The highest age distribution of smoked fish workers is at the age of > 51 years. Industrial owners must be more vigilant, because in that age range, workers are no longer young and can reduce the alertness of workers(13).

Based on data on working time of workers in a day, which is 8-10 hours. If it is assumed that the number of days worked 6 days per week, the number of hours worked in a week of 48-60 hours per week. Exposure frequency is 317-353 days/year, this is because there is no definite working day, working days depend on the production process. The production process depends on the catch of the fish, if the fish caught is limited then the price of fish is expensive and many industries do not carry out the production process. Working hours in the smoked fish industry are not following the recommendations of regulation of the Ministry of Health of Republic of Indonesia(14). Additionally, working hours that exceed standards can increase the likelihood of work accidents(15).

Based on data on working time of workers in a day, which is 8-10 hours. If it is assumed that the number of days worked 6 days per week, the number of hours worked in a week of 48-60 hours per week. Exposure frequency is 317-353 days/year, this is because there is no definite working day, working days depend on the production process. The production process depends on the catch of the fish, if the fish caught is limited then the price of fish is expensive and many industries do not carry out the production process. Working hours in the smoked fish industry are not following the recommendations of regulation of the Ministry of Health of Republic of Indonesia(14). Additionally, working hours that exceed standards can increase the likelihood of work accidents(15).

Based on Table 5 could be known the intake value of benzo[a]pyrene per day. The value of intake obtained will affect the level of health risk(10). This value is also different from research conducted in high school(10). This is because in this study, smoked fish workers have 7 to 46 years of exposure duration different from the previous study that had a maximum exposure duration of 6 years.

The calculation result of the RQ value in Table 6, it is known that all respondents have value of RQ > 1, means that the exposure value has non-carcinogenic health risk. Based on the calculation result in Table 7, it is known that all respondents have value of ECR > 10⁻⁴, which means they can pose carcinogenic risk(10). This is because in the ECR and RQ calculations, uses the intake value which is influenced by daily exposure time, exposure frequency and exposure duration. In contrast to previous study conducted in middle school, daily exposure time, exposure frequency and exposure duration were not as long as those of workers who have worked for years.

Conclusion

The conclusion of this study is the value level of carcinogenic risk is (ECR)>10⁻⁴ and value level of non-carcinogenic health risk> 1, so that the values of RQ and ECR are categorized as risky so health risk management needs to be done.

Conflict of Interest: This research is part of final task of University of Indonesia students, thus, there is no competition in conducting this research.

Ethical Clearance: The study was approved by the Institutional Review Board (IRB) of Faculty of Public Health, Universitas Indonesia.

Source of Funding: This research is self funding students

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Influence of Length and Frequency of Paan with the Occurrence of Gingivitis of Community in Toraja Regency

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ABSTRACT

Background: Periodontal disease is one of dental and oral health problems with high prevalence affecting all age groups. Gingivitis is one of periodontal disease that caused by bad habits, such as paan. Toraja is one of the tribes in South Sulawesi that is famous for the habit of paan.

Objective: To identify the influence of duration and frequency of paan with the occurrence of gingivitis in North Toraja district.

Method: This is an observational analytic with cross-sectional study design. The sample was taken by accidental sampling method. Examination was performed using periodontal probe with calculation of gingival index score (GI) as well as filling questionnaire and analyzed by chi-square analysis.

Result: The shorter duration of paan from less than 5 years all of the samples had gingival status with mild gingivitis. 5-10 years of paan all samples had moderate gingivitis, and length of paan for more than 10 years had 36.4% of samples with moderate gingivitis and 63.6% of the sample with severe gingivitis. In addition, the frequency of paan in the 3-day sample group experienced mild gingivitis. In the 3-to-5-week group experienced more moderate gingivitis, whereas in the cohort group more than 5 times daily experienced more severe gingivitis. The result of chi-square statistic test, seen p value: 0.000 (p <0.05), there is a significant correlation between the duration and frequency of paan with occurrence of gingivitis.

Conclusion: There is a significant influence between the duration and frequency of paan on the occurrence of gingivitis.

Keywords: gingivitis, duration of paan, frequency of paan, North Toraja district

Introduction

Periodontal disease is one of the most common dental and oral health problems that affects all age groups.¹ Nandya et al said the prevalence of periodontal disease in all age groups in Indonesia is 96.58 %.¹ The results of the Health Department of Indonesia (1999) that 73.5% of Indonesian population experience periodontal disease.²

Gingivitis is gingival inflammation that only covers the gingival tissue around the tooth.³ The main cause of gingivitis is due to the interaction between microorganisms in plaque and inflammatory cells of the tissue.²

Bad habits related to disorders of the gingiva is habit of paan.⁵ Paan is a hereditary activity associated cultural and social ceremonies and activities.⁶ This custom has been started since 2000 years ago in South Asia, Southeast Asia and the South Pacific.⁶ Betelnut is the fourth largest psychoactive ingredient after caffeine, nicotine and alcohol. Betelnut is also commonly used in paan habit.⁶

Based on dentistry side, the habit of chewing betelnut can cause periodontal disease.⁷ Periodontal disease is caused by calculus or tartar that caused by stagnation of pin salivary saliva due to the presence of lime.⁵ Combined
lime with betelnut leads to the emergence of a primary response to the formation of reactive oxygen compounds and may result oxidative damage to DNA in the buccal mucosal aspect. The process of chewing betelnut ends with a stream of rubbing a tobacco clump on the teeth to flatten the results of chewing betelnut. This habit is believed to be a substitute for brushing teeth.

Today’s habit is an issue that needs to get more attention, especially among people living in remote areas. Lack of self-awareness and poverty are factors that led to this growing habit among the community. Paan is the process of chewing the mixture of the selected element and wrapped in a betel leaf so as to produce a quid sulfur. Generally, the ingredients used to mimic consist of betelnut, betel leaf and lime. Estimated that more than 600 million people chew betelnut in various regions of the world.

In the Southeast Asia, tradition of chewing betelnut has begun 3000 years ago. The tradition of chewing betelnut cannot be ascertained where it came from. In Toraja, women on paan or ma’pangan (in the local language) is not something unusual.

Based on the habit of chewing betelnut in Toraja, we interested to observe the effect of duration and frequency of paan on the severity of gingivitis in the community in North Toraja district.

METHOD

This is an analytic observational with cross sectional study, conducted in September-October 2015 in Randan Batu Village, Sanggalangi Subdistrict, North Toraja District. The sample of this research is a total of 30 women aged 25-26 years in North Toraja District women aged 25-65 with a habit of paan at least 6 months, no systemic history and not in pregnant taken by accidental sampling with exclusion criteria if not willing to be examined and researched, smoking, using an orthodontic, in menstrual phase and ill.

This began with explanation of research procedure to sample then signing informed consent. The researcher asked how long the sample has performed the habit of paan and how many times the subjects doing paan in a day and a week and written on the questionnaire provided. For the severity of gingivitis the sample was calculated using the gingival index. The researchers looked at the gingival state of the sample, and examined it using a probe then recorded the score in the prepared format then calculate it using Gingival Index. The data analyzed using SPSS.

RESULT

<table>
<thead>
<tr>
<th>Characteristics of the study sample</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>50–54</td>
<td>7</td>
<td>23.3</td>
</tr>
<tr>
<td>55–59</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>60–64</td>
<td>7</td>
<td>23.3</td>
</tr>
<tr>
<td>65–69</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td><strong>Duration of paan</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 years</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>5 – 10 years</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>22</td>
<td>73.3</td>
</tr>
<tr>
<td><strong>Frequency per day</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 times</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>3–5 times</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>&gt;5 times</td>
<td>13</td>
<td>43.3</td>
</tr>
<tr>
<td><strong>Frequency per week</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 times</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>3–6 times</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>7 times</td>
<td>25</td>
<td>83.3</td>
</tr>
<tr>
<td><strong>Status of Gingivitis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>Medium</td>
<td>11</td>
<td>36.7</td>
</tr>
<tr>
<td>Severe</td>
<td>14</td>
<td>46.7</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1 shows the distribution of sample characteristics. There are seven people aged 50-54 and 60-64 years. Meanwhile, in terms of the duration of paan, there are 73.3% paan for more than 10 years. Based on frequency of paan, there are 43.3% sample with more than five times a day and there are 83.3% with sums up a week to seven times. Gingival status with gingival index measurements showed that most samples with severe gingivitis (46.7%).
Table 2: Mean of age distribution and gingival index score based on duration and frequency of paan

<table>
<thead>
<tr>
<th>Duration, frequency and time of chewing betelnut</th>
<th>Age</th>
<th>GI Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td><strong>Duration of paan</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 years</td>
<td>55.20 ± 7.79</td>
<td>0.68 ± 0.28</td>
</tr>
<tr>
<td>5 – 10 years</td>
<td>53.67 ± 1.15</td>
<td>1.73 ± 0.30</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>57.27 ± 6.78</td>
<td>2.11 ± 0.52</td>
</tr>
<tr>
<td><strong>Frequency per day</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 times</td>
<td>55.20 ± 7.79</td>
<td>1.10 ± 1.09</td>
</tr>
<tr>
<td>3–5 times</td>
<td>54.92 ± 7.05</td>
<td>1.65 ± 0.35</td>
</tr>
<tr>
<td>&gt;5 times</td>
<td>58.62 ± 5.56</td>
<td>2.29 ± 0.48</td>
</tr>
<tr>
<td><strong>Frequency per week</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 times/week</td>
<td>55.50 ± 9.19</td>
<td>0.40 ± 0.14</td>
</tr>
<tr>
<td>3 – 6 times/week</td>
<td>55.67 ± 9.01</td>
<td>1.66 ± 0.75</td>
</tr>
<tr>
<td>7 times/week</td>
<td>56.76 ± 6.47</td>
<td>1.97 ± 0.61</td>
</tr>
</tbody>
</table>

Table 2 shows the mean of age distribution and gingival index (GI) based on the duration of paan, paan frequency, and chewing time. The results showed that samples having paan for less than 5 years had the lowest average age among the other groups, followed by the lowest GI scores among others. Frequency category per day, samples who had paan more than five times a day reached 58 years. As for, the lowest GI score is frequency less than 3 times and the highest on the frequency more than five times. GI score increases with increasing frequency per week.

Table 3 shows the distribution of gingival status by age, paan frequency week, and chewing time. The highest number of samples have mild gingivitis status in the 45-49 years (40%). The age category 60-64 years (57.1%) and 65-69 years (66.7%) had the highest number of severe gingivitis compared to other categories. Based on frequency of weekly, total 52% sample with paan seven times a week had severe gingivitis.

Table 4 shows the correlation of paan and frequency of paan per day with gingival status. Sample with less than 5 years of age had gingival status with mild gingivitis and no samples with severe gingivitis. A 5-10 year old samples had moderate gingivitis, whereas in the older sample over 10 years had 36.4% of the sample with moderate gingivitis and 63.6% with severe gingivitis. Based on the result of chi-square statistic test, the p value is 0.000 (p <0.05), there is a significant correlation between length of paan and occurrence of gingivitis.

This study showed that 80% of sample were on paan three times a day had a mild gingival inflammation. Category of group paan 3-5 times a day with moderate gingivitis is 83.3%. Meanwhile, the group of samples with paan category more than five times a day, had the highest sample having severe gingivitis (92.3%). The statistical test, Chi-square, shows p value: 0.000 (p <0.05), which means that there is a significant correlation between daily frequency of paan and gingival status.

Table 3: Distribution of gingival status based on age and paan frequency per week

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mild</th>
<th>Medium</th>
<th>Severe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45 – 49</td>
<td>2 (40)</td>
<td>2 (40)</td>
<td>1 (20)</td>
<td>5 (16.7%)</td>
</tr>
<tr>
<td>50 – 54</td>
<td>1 (14.3)</td>
<td>4 (57.1)</td>
<td>2 (28.6)</td>
<td>7 (23.3%)</td>
</tr>
<tr>
<td>55 – 59</td>
<td>0 (0)</td>
<td>2 (40)</td>
<td>3 (60)</td>
<td>5 (16.7%)</td>
</tr>
<tr>
<td>60 – 64</td>
<td>1 (14.3)</td>
<td>2 (28.6)</td>
<td>4 (57.1)</td>
<td>7 (23.3%)</td>
</tr>
<tr>
<td>65 – 69</td>
<td>1 (16.7)</td>
<td>1 (16.7)</td>
<td>4 (66.7)</td>
<td>6 (20%)</td>
</tr>
<tr>
<td>Frequency per week</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 times</td>
<td>2 (100)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>2 (6.7%)</td>
</tr>
<tr>
<td>3–6 times</td>
<td>1 (33.3)</td>
<td>1 (33.3)</td>
<td>1 (33.3)</td>
<td>3 (10%)</td>
</tr>
<tr>
<td>7 times</td>
<td>2 (8)</td>
<td>10 (40)</td>
<td>13 (52)</td>
<td>25 (83.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>5 (16.7)</td>
<td>11 (36.7)</td>
<td>14 (46.7)</td>
<td>30 (100%)</td>
</tr>
</tbody>
</table>
Table 4: The correlation of length and frequency of paan per day with gingival status

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gingival status</th>
<th></th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mild n (%)</td>
<td>Medium n (%)</td>
<td>Severe n (%)</td>
<td></td>
</tr>
<tr>
<td>Length of paan (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5</td>
<td>5 (100)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>5 (16.7)</td>
</tr>
<tr>
<td>5 – 10</td>
<td>0 (0)</td>
<td>3 (100)</td>
<td>0 (0)</td>
<td>3 (10)</td>
</tr>
<tr>
<td>&gt;10</td>
<td>0 (0)</td>
<td>8 (36.4)</td>
<td>14 (63.6)</td>
<td>22 (73.3)</td>
</tr>
<tr>
<td>Frequency of paan per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3 times</td>
<td>4 (80)</td>
<td>0 (0)</td>
<td>1 (20)</td>
<td>5 (16.7)</td>
</tr>
<tr>
<td>3–5 times</td>
<td>1 (8.3)</td>
<td>10 (83.3)</td>
<td>1 (8.3)</td>
<td>12 (40)</td>
</tr>
<tr>
<td>&gt;5 times</td>
<td>0 (0)</td>
<td>1 (7.7)</td>
<td>12 (92.3)</td>
<td>13 (43.3)</td>
</tr>
<tr>
<td>Total</td>
<td>5 (16.7)</td>
<td>11 (36.7)</td>
<td>14 (46.7)</td>
<td>30 (100)</td>
</tr>
</tbody>
</table>

Discussion

In a study conducted by Marcelina et al in Rembon Sub-district of Tana Toraja, only the age group of 50 years and older still doing more paan habits. Similarly, research conducted in September 2015-October 2015 in North Toraja.

The distribution of the sample shows that only women aged 45-65 years who still do paan activities. This result is different with research conducted by K.V. Siagian that found most Papuan tribe of betelnut in Manado was dominated by 21-25 years. According to Sayuti Hasibuan; on the characteristic of paan activity in Karo regency of North Sumatera, the frequency of paan more than 10 years is the most with the percentage of 37.76%, also at the most frequent paan frequency per day at 5-10 times with percentage of 48.98% and more than 10 times a day with a percentage of 37.76%. This is similar with our study that shows most of subjects perform paan habits more than 10 years (73.3%). Also, the frequency of chewing betelnut more than 5 times a day is 43.3%.

Krista Veronika Siagian on her study in Manado showed that the calculus score of 1.34 was higher, almost 1.5 times the average debris score of 0.98. This is similar with other studies that show an increase in occurrence of calculus in sprinklers.

The results showed that the longer one takes time for paan time the higher the value of GI. Thus, the frequency of paan per day is the severity of gingivitis increases with the more frequent subjects paan.

The distribution of gingival status in Table 3 showed that the highest number of samples had mild gingivitis status in the 45-49 years (40%). As for the condition of severe gingivitis, it was seen that the age category 60-64 years and 65-69 years had the highest number of samples compared to other categories. This is because subjects aged 60-65 years have long performed paan habits compared to other age groups as shown in Table 2 that subjects with more than 10 years of age had the highest average age among the other groups followed high GI scores or increasing degree of gingivitis.

In the present study, distribution of gingival status based on weekly frequency, a total 52% who had paan 7 times a week have gingivitis with severe degrees. This may be due to the more frequent subjects contact between the excipients and the ingredients of the toothpaste (quid) such as lime can causes the accumulation of calculus. Also the effects of arekolin are able to block cell attachment, cell spread and migration cells and decreases cell growth and collagen synthesis.

This is in line with the study of Sayuti Hasibuan et al in Tanah Karo residents of North Sumatra showed that there is a significant correlation with the presence of oral mucosal lesions such as the length and more often a person performs paan habits, the higher the risk for exposure to lesions oral mucosa.

In this study all subjects have the same composition of betelnut sugi, which consists of a mixture of betel leaf, betelnut, and lime. Based on the previous study, all samples with paan less than 5 years have gingival status with mild gingivitis condition and no sample with severe
gingivitis condition. There is a significant correlation between the length of paan and the occurrence of gingivitis.

This study showed that a total 80% of sample paan three times a day had a mild gingivitis. Meanwhile, the group of samples with paan category more than five times a day, had the highest sample having severe gingivitis (92.3%).

There is a correlation between daily frequency of paan and significant gingival status. In line with studies by Binns C. et al and Girish Parmar et al. that there is a link between paan habits and the occurrence of periodontal disease is gingivitis. This study proves that there is a statistically significant correlation between the occurrences of gingivitis with paan habits. These results indicate that the longer a person performs paan habits, the more often a person performs paan habits the higher the risk of someone to experience gingivitis.18,19

**Conclusion**

There is a significant influence between the duration of paan habits on the occurrence of gingivitis and the frequency of paan habits per day and per week on the occurrence of gingivitis.

**Conflict of Interest:** There is no conflict of interest in this study.

**Source of Funding:** Domestic government

**Ethical Clearance:** This study obtained a label of ethics escaped by the number: 0061/PL09/KEPKFKG - RSGMUNHAS/2018 and register number UH 17120067 on October 9, 2018.

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Identification of Early Childhood Caries (ECC) in Children’s Preschool Based on Demographic Risk Factor and pH Saliva

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ABSTRACT

Background: Early childhood caries (ECC) is the most common caries in children and is often found in children under five years of age (toddlers), with the highest spread in children aged three years. The etiology of ECC is the host (teeth and saliva), microorganisms, substrates, and time, these four factors interact and influence each other thus caries are formed on the teeth. In addition to the factors that exist in the oral cavity that are directly related to caries, there are predisposing factors including age, gender, education level, economic level, environment, attitudes and behaviors related to dental health.

Objective: To know the ECC description of preschool children in East Luwu Regency based on demographic risk factor which includes education, employment, and parents’ income and the childrens’ saliva pH.

Method: This type of research was observational descriptive and used a cross sectional study design. The research subjects were 410 Preschool students and parents/guardians in East Luwu Regency. Variable assessment was done using a questionnaire and intra-oral examination. Data in this study are presented in tables, graphs and narratives.

Results: Overall, there were more children with ECC (68.54%), while those without ECC (31.46%). Most ECC was found based on demographic risk factor parental income <2 million (52.31%) and the pH of saliva was very acidic (56.23%)

Conclusion: Most preschool children in East Luwu Regency suffer from ECC, with the most risk factors being very acidic pH. High acidity causes a large number of caries.

Keywords: education, employment, income, ECC, preschool children

Introduction

Caries is one of the most common dental and oral diseases in all age groups. According to Keyes, quoted in Kidd and Bechal, argued the theory of the three main factors causing caries, namely teeth and saliva, microorganisms and substrates or food, then in the formation of caries the three main factors must exist and interact with each other. According to Newburn, quoted in Kidd and Bechal, the three factors were added to the time factor thus it became four factors that caused caries.1,2 In addition to the factors that exist in the oral cavity that are directly related to caries, there are predisposing factors including age, gender, education level, economic level, environment, attitudes and behaviors related to dental health. ECC is one of the most common caries conditions that occurs in children.1,3,4

ECC according to the American Academy of Pediatric Dentistry 2008 (AAPD) is decay on one or more surfaces that has cavities or not, tooth loss due to caries, or the presence of permanent dental fillings at the age of six. Some children are often affected by caries in a number of teeth, especially in children aged 3-4 years. This caries is called rampant caries. However, there was no clear difference between “carious rampage” and “nursing caries” so that both terms were considered the same.1,4 At the age of 3-6 years, there are one or more carious teeth, tooth loss due to caries, there are patches in the primary teeth, or decayed, missing, filled scores ie ≥4 (age 3 years), ≥5 (4 years old), ≥ 6 (age 5 years) is a severe early childhood caries (S-ECC).6,7
Parental lack of attention and awareness of the importance of maintaining and instilling dental and oral health from an early age can result in caries problems that can affect the health and quality of life of children. ECC occurs very quickly and affects several teeth and often causes pain, eating difficulties and speech disorders.8,9

Several studies have been conducted that show that children living in environments with poor socioeconomic status have an increased prevalence of ECC. Other studies suggest that there is a significant relationship between socioeconomic status and caries number.10 Based on several studies that salivary pH can be considered to have a strong relationship with the incidence of caries in children. Caries is a process of demineralization-remineralization, meaning that if the oral environment becomes acidic then the hydroxapatite demineralization process will dissolve, but with the increase of pH a remineralization process will occur.11

The choice of location in East Luwu Regency was based on consideration of 2016 data, in East Luwu Regency there were 2 hospital units namely the Regional Government General Hospital located in Wotu Regency and a private Hospital located in Nuha Regency. At the Regency level there are 15 Puskesmas, 266 Posyandu, and 25 dispensaries. In addition to addressing the health problems of East Luwu residents there were 14 specialists, 46 general practitioners, 23 dentists,14 pharmacists, 215 midwives, 317 nurses and 271 traditional birth attendants, while expert doctors were only in Wotu Regency which was four people. 11 East Luwu Regency is a district that is still under construction. This study was intended to know the description of ECC in preschool children in East Luwu Regency.

**Research Method**

This study is included the type of analytic observation research with a cross sectional approach. This research was carried out on July 23-25 2018 in East Luwu Regency. The population studied were all preschool students in East Luwu Regency and parents who were present at the time of the study. The sample in this study is part of the population, determining the subject by purposive sampling method.

There are two main variables in this study, namely the independent variables of demographic factors which include education, employment, income and salivary pH, while the dependent variable is early childhood caries. The tools and materials used in this study were diagnostic tools (sendo, mouth glass, tweezers), litmus paper, nierbeken, handscoon, masks, informed consent sheets, ECC or Non ECC assessment sheets, questionnaires, stationery.

Assessment of education, work, opinions by using quizione. ECC assessment was done through intraoral examination in children whose results were recorded on the status card. It was stated as ECC if there were whitespot lesions and carious lesions on one or more surfaces of damaged, lost or patched primary teeth, while Non ECC when no carious teeth were found from the results of intraoral examination in children who were the study sample. Measuring the degree of acidity (pH) using litmus paper was inserted in the oral cavity and placed on the tongue of the subject, given a time lag until there was a change in the viscus and then lifted and match the pH indicator to know the pH of saliva. The normal salivary acidity (pH) was 7, the acidic condition was 6.5, while the very acid was 5.5-4.5.

**Research Results**

**Tabel 1: Distribution of Subjects Based on Variable Demographic Risk Factors (education, employment, parental income) and Children Saliva pH**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Subjects (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father’s Education</td>
<td>410</td>
<td>100</td>
</tr>
<tr>
<td>Mother’s Education</td>
<td>410</td>
<td>100</td>
</tr>
<tr>
<td>Father’s Occupation</td>
<td>410</td>
<td>100</td>
</tr>
<tr>
<td>Mother’s Occupation</td>
<td>410</td>
<td>100</td>
</tr>
<tr>
<td>Parents’ Income</td>
<td>410</td>
<td>100</td>
</tr>
<tr>
<td>Children Saliva pH</td>
<td>410</td>
<td>100</td>
</tr>
</tbody>
</table>

The table above shows the research subjects based on the level of education of the father and mother that mostly are high school level as many as 205 and 153. Based on the occupation of the father mostly are workers or employees (148 people), while based on work the majority does not have jobs (170 people). Based on the income level, most parents earn ≥ 2 million (209 people). Based on the salivary pH of the children most children have a very acidic salivary pH (208 children).
Tabel 2: Distribution of ECC Based on Demographic Risk Factors (education, employment, and income) and Children Saliva pH

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Subjects (n)</th>
<th>ECC</th>
<th>Non ECC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Father’s Education</td>
<td>410</td>
<td>281</td>
<td>68.54</td>
</tr>
<tr>
<td>Mother’s Education</td>
<td>410</td>
<td>281</td>
<td>68.54</td>
</tr>
<tr>
<td>Father’s Occupation</td>
<td>410</td>
<td>281</td>
<td>68.54</td>
</tr>
<tr>
<td>Mother’s Occupation</td>
<td>410</td>
<td>281</td>
<td>68.54</td>
</tr>
<tr>
<td>Parents’ Income</td>
<td>410</td>
<td>281</td>
<td>68.54</td>
</tr>
<tr>
<td>Children Saliva pH</td>
<td>410</td>
<td>281</td>
<td>68.54</td>
</tr>
</tbody>
</table>

Based on the table above shows that overall there are more children who suffer from ECC (68.54%) than those without ECC (31.46%), most of them are children with an education level of high school fathers (48.75%), and children with mother’s education level of high school (38.44%). The distribution of ECC patients based on father’s work, the most is children with the work of a father as a worker/employee (33.10%), while based on the work of the mother, the most are children with mothers who do not work (44.48%). Distribution of ECC patients is based on parents’ income, the most are children with income levels of less than two million (52.31%), and based on the salivary pH of children, the most are children with very acidic salivary pH (56.23%).

Distribution Diagram of ECC Based on Demographic Risk Factors (education, employment, and income) and Children Saliva pH

Distribution chart of ECC patients in the diagram shows that ECC is most prevalent in subjects based on risk factors for salivary pH (56.23%).
Discussion

Based on the level of education of the father and mother, the most ECC distribution is in children with the education level of high school parents. These results, in accordance with a study of kindergarten students in the city of Padang showed that parents who were not scholars, their children experienced a lot of ECC. A similar study was conducted on elementary school students in Yogyakarta, Sleman Regency stating that the final education of parents affected the number of child caries. The same results were also found in several studies stating that the higher the level of one's formal education, the better the knowledge of attitudes and healthy behaviors. But based on research carried out on preschool children at Gunung Anyar Surabaya stated that parental education does not affect the ECC and research conducted in Brazil states that the higher the dmft index of children with a high education level of parents. This depends on the care and maintenance of the child’s teeth.

Based on the type of work of the father, the most ECC distribution is in children with the work of the father as a worker/employee. This result, in accordance with the research conducted on elementary school students in Yogyakarta, Sleman Regency showed that the number of child caries was found in children with the work of parents as laborers/employees. The results of a similar study conducted on elementary school students in Manado showed that the highest number of caries was in children whose parents worked as laborers.

Based on the type of work of the mother, the most ECC distribution is in children with mothers who did not work. These results, in accordance with research conducted at kindergarten students in Padang City, showed that the number of child caries was found in children with mothers who did not work. Similar studies conducted in preschool children at Gunung Anyar Surabaya stated that the largest percentage of ECC was in mother as a housewife. The study conducted in Vojvodina, Republic of Serbia stated that ECC was more in children with parents who did not work.

Other studies suggest that caries status and dental hygiene are better for children with middle-to-older jobs, this is because older people with middle-to-upper jobs consider it important to maintain dental health and expect their teeth to function properly as long as possible in their child's oral cavity.

Indirectly, the work of parents has a relationship with the incidence of dental caries. Factors such as busy at work make parents have limited time in monitoring the growth and development of children’s health. Work is also an effort to earn income in fulfilling the necessities of life and getting a good place of health care, thus the better the type of work someone gets, the more fulfilled their life needs and family health.

Based on the level of income of parents, the most ECC distribution is in children with income levels of parents of less than two million. These results, according to a study conducted in Banjarmasin, showed that the number of child caries was high in children whose parents were low-income. But based on the research conducted in Enugu, Nigeria ECC is found mostly in children with high socio-economic. Other research conducted on children aged 0-3 years in the city of Bandung shows that parents with low-middle income, have a low risk of dental caries. Income will affect a person’s lifestyle, children from families with middle to upper income are more tend to consume foods that are cariogenic, because children from this family are better able to buy food that is much cariogenic. According to AAPD, family economic status is not a major factor, but can be a predisposing factor for child caries.

Based on the salivary pH level of the child, the most ECC distribution is in children with very acidic salivary pH. This result, in accordance with research conducted on elementary school children in Medan, showed the highest number of children who experienced caries in children with acidic salivary pH. Another study conducted in Neglasari Sub-district, Tangerang City stated that there was a significant correlation between the pH of children’s dental plaque and ECC. But in a study conducted in India stated that there was no difference between the salivary pH of children who did not experience ECC and those with ECC.

The degree of acidity (pH) of saliva is an important part in increasing tooth strength because it can increase the occurrence of remineralization. A decrease in salivary pH can cause tooth demineralization and the presence of remineralization will reduce the possibility of caries. Remineralization is a process on the surface of the tooth that will obtain minerals again.
Conclusion

Based on the research that has been done, it can be concluded that the majority of preschoolers in East Luwu Regency suffer from ECC, most with risk factors for the pH of very acidic saliva. High acidity causes a large number of caries.

Conflict of Interest: There is no conflict of interest in this study.

Source of Funding: Domestic government

Research Ethics

Research on demographic factor and salivary pH with ECC in preschool children in East Luwu Regency has received a Recommendation for Ethical Approval Number: 0062/PL.09/KEPK FKG-RSGM UNHAS/2018 and has been through informed consent by parents/guardian of the subject.

REFERENCES


Comparison of Fibroblast amount on the Gingival Healing Process in the Wound Applied by Platelet-Rich Plasma (PRP) and Chlorhexidine (CHX)

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ABSTRACT

Aim: This study was aimed to compare the amount of the fibroblast on the gingival healing process using platelet-rich plasma (PRP) and chlorhexidine (CHX).

Materials and Method: Fifteen homogen mice were included in this study. Five mice in PRP group, five in CHX group and four in control group. One mice was sacrificed for PRP preparation. 10 mm incision was made in mandibular gingiva and applied with PRP and CHX according to their group. The fibroblast of the healing process were analyzed with electron microscopic at the 1st, 3rd, and 5th day.

Result: In histopathologic analysis, the healing process was greater in the experimental group than in control group on 1st and 3rd day, with the increasing amount of the fibroblast. The fibroblast enhanced significantly with P>0.009, but on the 5th day the healing process was average at the experimental and control group.

Conclusion: The addition of PRP significantly increased gingiva healing process. PRP were important because of the growth factor and may be useful in the future to increase the healing process.

Clinical Significance: The goal of the periodontal treatment are enhance periodontal health and obtain gingival aesthetic. All these goals are depend on the success of the healing process which can be obtained from the periodontal surgery. Nowadays, clinician use Platelet-Rich Plasma (PRP) to enhance the healing process.

Keywords: Periodontal healing, PRP, Wound Healing

Introduction

The goal of periodontal treatment is to improve periodontal health and likewise the patient’s need for aesthetic importance and functional requirements. To achieve this goal, periodontal treatment should be able to handle or increase attachment levels, reducing probing depths because these parameters are used as an illustration of increased dental retention.¹²

For more than three decades, the main goal of periodontal treatment has shifted from improving to rebuilding periodontal tissue by repairing the damage caused by the disease process.²³

Various animal studies have been conducted to examine the regeneration of periodontal tissues including insulin-like growth factor, fibroblast growth factors, epidermal growth factor, platelet-derived growth factors, vascular endothelial growth factors, parathyroid hormone, transforming growth factor-β and bone morphogenic proteins.⁴⁵

The main function of platelet is to prevent acute blood loss and repair the vascular wall and maintain tissue after injury. During the healing process, platelets are activated through contact with collagen, exposed to the bloodstream after endothelial injury. Platelet products include Platelet Rich Plasma (PRP) which can be used with or without previous platelet activation. PRP applications in different tissues have yielded promising results in different pathologies such as acute and chronic injuries to bone and cartilage.⁶⁷
The aim of this study was to evaluate the healing process of gingiva and fibroblast formation on the wound that has been applied with platelet rich plasma.

Method

This study was a laboratory experiment conducted at the Laboratory of Department of Biology, Faculty of Mathematics and Natural Sciences, Makassar State University; Veterinary Center Maros; and Pathology Anatomy Laboratory, Faculty of Medicine, Hasanuddin University. Study sample were mice that selected based on the inclusion criteria and exclusion criteria in this study. Inclusion criteria were male healthy mice weighing 300-400 grams, and age between 4-8 months. Exclusion criteria were no weight loss more than 10% after the adaptation period in the laboratory.

Prior to the experiment, mice were kept and adapted in animal experimental enclosures made of plastic basins and wires as a cover. Adaptation and pretreatment performed for one month to be checked for health to ensure their good health. Given a special feed for and water, that was also kept on room temperature in the scientific range.

One mice was sacrificed to have blood taken on the heart, and the blood was taken using 3 ml syringe and put in the tube. The tube was centrifuged for 10 minutes at first and another 8 second at 2000 rpm to obtain the poor plasma platelet in the first layer, rich fibrin platelets in the second layer and red blood cloth on the third layer. When RBC was separated, PPP and PRF were centrifuged again for 8 minutes at 1000 rpm. From the second centrifuge, we obtained platelet rich plasma without coagulant that will be applied to the wound. 14 mice were divided into 3 groups, group I (five mice) will be applied with platelet rich plasma (PRP), Group II (5 mice) will be applied with Chlorhexidine gel, and group III (4 mice) were not applied anything. Operative area were disinfected with povidone iodine, then local anesthetic solution were deposited and incision were made using a scalpel on vestibulum region. Histopathologic examination to calculate the number of fibroblasts were done on the 1st, 3rd, and 5th day after treatment. The tissue were taken and fixed on 10% formaline solution and given HE staining to checked under microscope with 40x viewing field.

Results

Table 1: Average and standard intersections of fibroblasts on each group

<table>
<thead>
<tr>
<th>Day</th>
<th>Group</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>CHX</td>
<td>25.500</td>
<td>7.7782</td>
</tr>
<tr>
<td></td>
<td>CONTROL</td>
<td>25.500</td>
<td>2.1213</td>
</tr>
<tr>
<td></td>
<td>PRP</td>
<td>29.500</td>
<td>2.1213</td>
</tr>
<tr>
<td>Day 3</td>
<td>CHX</td>
<td>22.000</td>
<td>8.0416</td>
</tr>
<tr>
<td></td>
<td>CONTROL</td>
<td>23.250</td>
<td>5.0580</td>
</tr>
<tr>
<td></td>
<td>PRP</td>
<td>34.500</td>
<td>6.3640</td>
</tr>
<tr>
<td>Day 5</td>
<td>CHX</td>
<td>18.500</td>
<td>6.3640</td>
</tr>
<tr>
<td></td>
<td>CONTROL</td>
<td>21.000</td>
<td>1.4142</td>
</tr>
<tr>
<td></td>
<td>PRP</td>
<td>15.000</td>
<td>2.1602</td>
</tr>
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</table>

Table 2: Data Analysis

<table>
<thead>
<tr>
<th>Df</th>
<th>Sum Sq</th>
<th>Mean Sq</th>
<th>F value</th>
<th>Pr(&gt;F)</th>
</tr>
</thead>
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<tr>
<td>Day</td>
<td>2</td>
<td>381.1</td>
<td>190.56</td>
<td>6.537</td>
</tr>
<tr>
<td>Group</td>
<td>2</td>
<td>50.9</td>
<td>25.43</td>
<td>0.872</td>
</tr>
<tr>
<td>Day:group</td>
<td>4</td>
<td>250.6</td>
<td>62.65</td>
<td>2.149</td>
</tr>
<tr>
<td>Residuals</td>
<td>15</td>
<td>437.2</td>
<td>29.15</td>
<td>0.00909 **</td>
</tr>
<tr>
<td>Signif. codes:</td>
<td>0 '***'</td>
<td>0.001 '***'</td>
<td>0.01 '**'</td>
<td>0.05 '.'</td>
</tr>
</tbody>
</table>

Table 1 showed the average mean number of fibroblast on the three groups. The highest rate of fibroblasts was on the third day of PRP application. Diagram 1 showed the average value of the number of fibroblasts by group and by day. In the control group, the average number of fibroblasts on the first day was 25, 23 on the third day, and 21 on the fifth day. In the group given Chlorhexidine, the average number of fibroblasts on the first day was 25, then decreased to 22 on third day and decreased again to 18 on the fifth day. In the group given the PRP, on the first day the average number of fibroblasts was 29, then increased to 34 on the third day and decreased to 15 on the fifth day.
In the treatment group, p-value was 0.43818 that mean there was no significant difference in the amount of fibroblasts between the control group, the chlorhexidine group, and PRP group.

In the day-interaction and treatment group, p-value was 0.12480, this value was not significant at 95% significance level (p-value = 0.12480; p-value> 0.05). Thus, there is no interaction effect between day and treatment on the amount of fibroblast. For this interaction group further analysis is done to ascertain whether or not there is a significant interaction.

Discussion

From the results of fibroblast examination in all groups, the highest amount of fibroblast was found in platelet rich plasma group on the third day, which was 34. Platelets are activated for aggregation by open collagen (intrinsic system). At the same time, the injured vein vasoconstricted, triggered by platelets, to reduce blood loss and fill tissue gaps with blood clots consisting of cytokines and growth factors. Furthermore, blood clots contain fibrin molecules, fibronectin, vitronectin and thrombospondine, forming a temporary matrix as a scaffold structure for migration of leukocytes, keratinocytes, fibroblasts and endothelial cells and also acts as a reservoir growth factor. Vasoconstriction occurs by coagulant formation leading to local perfusion failure with successive oxygen depletion, increased glycolysis and pH change. Vasoconstriction is then followed by vasodilation in which traumatized tissue undergoes a reperfusion phenomenon. Both platelets and leukocytes release cytokines, chemokines and growth factors to activate inflammatory processes, stimulate collagen synthesis, activate fibroblast transformation into myofibroblasts, initiate angiogenesis and support the process of re-epithelialization.8,9

Neutrophil formation is very important on the first days after injury because of its ability in protease secretion and phagocytosis kill local bacteria and help reduce necrotic tissue. Neutrophil initiates debridement by releasing highly active antimicrobial agents ie cationic and eicosanoid peptides, and proteinases, namely elastase, cathepsin G, proteinase 3 and urokinase-type plasminogen activator. Approximately 3 days after the injury, macrophages enter the injury zone and support the ongoing process by performing pathogenic phagocytosis and the remnants of cell formation and secreting growth factors, chemokines and cytokines. Macrophages have many functions including defense response, promotion and inflammatory resolution, apoptotic cell transfer and cell proliferation support and tissue recovery after injury.8

Compared with the other treatment groups, PRP group had the highest mean number of fibroblasts although only occurred on the third day after treatment. Platelet rich plasma achieves homeostasis through the formation of fibrin clots initiated by platelet activation and aggregation. The platelet aggregation is produced by fibrin polymerization of fibrinogen monomers in the presence of calcium and thrombin. The results of platelet aggregation in platelet platelets are held in place by blood clots and inhibit blood flow. In addition to maintaining homeostasis, the fibrin clot then produces a matrix for the migration of tissue-forming cells, including existing fibroblasts responsible for the synthesis of collagen and endothelial cells involved in angiogenesis. The traction force generated by these migratory cells in fibrin clots can assist wound contraction. This migration of cells together is also responsible for overhauling blood clots into tissue repairment.10,11,12

Differences in PRP Group and Chlorhexidine Group: On histopathological examination between groups treated with PRP and chlorhexidine, there was a difference in the number of fibroblasts on the first day, this is because on the first day the most widely formed are inflammatory cells resulting from the inflammatory response. When the inflammatory blood vessels becomes leaky, it releases plasma and neutrophils into the surrounding tissues. As neutrophils digest bacteria and debris, it will die and release intracellular enzymes in the surrounding matrix. Furthermore, fibrin is broken down as part of the phagocytic process, degradation products attract the subsequent involved cells such as fibroblasts and epithelial cells.13,14,15

On the third day, there was a significant difference on the amount of fibroblast between groups that was given PRP and chlorhexidine. This is because PRP has growth factors that is important in wound healing processes, such as platelet-derived growth factor (PDGF), transforming growth factor β1, β2, β3 (TGF-β1, β2, β3), platelet
derived angiogenesis factor, insulin-like growth factor 1 (IGF-1), platelet factor 4 (PF-4), epidermal growth factor, epithelial cell growth factor (VGA), vascular endothelial cell growth factor (VEGF), basic fibroblast growth factor (bFGF) and other cytokines.\textsuperscript{16,17,18}

The second group which is also important from growth stimulation molecules is growth-derived platelets (PDGFs). These molecules are contained in platelet granules, and the release of PDGF at the injury sites during formation of clots are essential for the repair process. PDGF is closely related to the oncogene (v-sis) virus. Thus, molecules such as growth factor are involved in controlling the growth of transformed cells. Like EGF, the response to this stimulus is determined by the presence of certain PDGF receptors. PDGF is produced in two isoform molecules.\textsuperscript{16,17}

Fibroblast growth factor refers to a group of proteins that interact with one or more receptors in different cell types. FGF-1 and -2 (FGF acid and base) are important because of their ability to stimulate cell growth and capillary cell invasion in various models. Most forms of FGF have growth factor, causing many cell populations, but endothelial cells seem to have greater sensitivity.\textsuperscript{18}

Growth factors 1 and 2 that specifically stimulate proliferation and differentiation. The process of healing epithelial cell wound due to the unique receptor on these cells. Both growth factors have a classic paracrine action because they are produced in the dermis and act on the epidermis. Vascular endothelial growth factor (VEGF) or vascular permeability factor is the most selective growth factor for endothelials.\textsuperscript{19,22,23}

In chlorkhexidine group, the number of fibroblasts on 1\textsuperscript{st}, 3\textsuperscript{rd}, and 5\textsuperscript{th} day is relatively in the same quantity, this is because chlorhexidine is an antiseptic that after up to 24 hours there is an increase in new connective tissue cells, just below the surface layer of inflammation and necrosis. The connective tissue grows to the coronal surface, creating new gingival margins and sulcus. The epithelial activity on the margin peaks at 24 to 36 hours. New epithelial cells originate from the basal layer and epithelial spine layer from the wound margins, migrating toward the wound on the fibrin layer which is then absorbed and replaced by the connective tissue layer. Epithelial cells progressed in an unorganized motion, with cells mounted on the substrate by hemidesmosome and new basal lamina.\textsuperscript{20}

This study was different of than previous study, whereas this study directly applied CHX after gingivoplasty and then evaluated on day 1, 3 and 5, while the other study CHX was given on day 7 and 14 after gingivoplasty.\textsuperscript{19} Under normal circumstances, fibroblast division activity is rarely seen, but cell injury appears to be more active in producing extracellular matrices. Proliferation of fibroblasts in the wound healing process is naturally stimulated by interleukin-1b (IL-1b), platelet derived growth factor (PDGF), and fibroblast growth factor (FGF). In addition, another study revealed that fibroblast migration in the area of the injury is stimulated by transforming growth factor (TGF), a growth factor produced by granulation tissue formed during the inflammatory process. The process of wound healing is strongly influenced by the role of migration and proliferation of fibroblasts in the injury site.\textsuperscript{19} The more specific function of collagen is to form a new connective tissue matrix and by removing the substrate by fibroblasts, indicating that macrophages, new blood vessels and fibroblasts as a unit.\textsuperscript{19,20} The limitation of this study was antiseptic and PRP application were given on anesthetized sample with short duration.

**Conclusion**

Platelet-rich plasma (PRP) is an autologous blood derivative that contains supraphysiologial platelet concentrations that aid in tissue regeneration as it is rich in growth factors and other cytokines. Platelet-rich plasma administration on the wound can increase the number of fibroblasts that will accelerate tissue healing process. Platelet Rich Plasma (PRP) is rich in growth factor, such as platelet-derived growth factor, transforming growth factor β1, β2, β3 (TGF-β1, β2, β3), and platelet derived angiogenesis factor (PDAF) new cells on wound healing process.

**Conflict of Interest:** There is no conflict of interest in this study.

**Source of Funding:** Domestic government

**Ethical Clearance:** This study obtained a label of ethics escaped by the number: 0066/PL09/KEPKFKG - RSGMUNHAS/2018 and register number UH 17120068 on Oktober 9, 2018.
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Analysis of Ascorbic Acid in Gingival Handling of Children’s Mouth Cavity

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ABSTRACT

Background: Periodontal disease in children and adolescents is common. Periodontal disease that mostly occurs in children and adolescents is inflammation of the gingival tissue. Inflammation of the gingival tissue is called gingivitis. Gingivitis associated with tooth eruption which often occurs. This gingivitis can be caused by a high risk of plaque accumulation in the area of the deciduous primary teeth and erupting permanent teeth, because oral hygiene may be difficult or uncomfortable to perform. Nutrients derived from food act as antioxidants, coenzymes in the formation of energy and metabolic processes, and components of tissue structures that keep the body’s system functioning properly and maintain general health, including the health of the oral cavity. Ascorbic acid plays a number of metabolic roles that make this substance important for maintaining connective tissue integrity. Materials and methods: This type of research is experimental research with a pretest-posttest design with a control group with a purposive sampling technique. Examination to get children with erupted gingivitis was carried out on all students of class I-VI SDIT Ar-Rahmah and obtained 30 children who met the inclusion and exclusion criteria. The samples obtained were divided into two groups, namely the group of children given ascorbic acid and the control group who were not given ascorbic acid. Gingival inflammation was measured using the gingival index at the time before administration of ascorbic acid, one week, and two weeks after administration of ascorbic acid. Measurements were made in both the treatment and control groups. The statistical test used was ANOVA Repeated test. Results: ANOVA Repeated test results showed a significant difference in the average gingival index value between groups given ascorbic acid and the control group (p <0.05). Conclusion: There is an effect of giving ascorbic acid to children with erupted gingivitis.

Keywords: erupted gingivitis, ascorbic acid, gingival index

Introduction

Dental and oral diseases can be experienced by various people in various age groups, including children. Dental and oral diseases that are commonly experienced are caries and periodontal disease.¹

Periodontal disease that mostly occurs in children and adolescents is inflammation of the gingival tissue. Gingivitis is characterized by inflammation of the gingiva without attachment to connective tissue or bone loss.²,³

Several epidemiological studies have shown that gingivitis of various severity is commonly found in children and adolescents.⁴ Based on the results of the 2013 Riskesdas, dental and oral problems experienced by children aged 5-9 years are 28.9% and children aged 10-14 years at 28.5%, and the prevalence of the population that has the highest dental and oral problems in Indonesia, namely in South Sulawesi province at 36.2%.⁵
Nutrition derived from food acts as an antioxidant, coenzyme in the formation of energy and metabolic processes. Ascorbic acid is known to play a role in the synthesis of intercellular substances and the formation of collagen fibers in various connective tissues, for example muscle and facial tissue, and calcified tissue matrix such as alveolar bone and teeth.

Healing inflammation of gingival tissue at the time of tooth eruption can be helped by additional nutrients, one of which is to take vitamins. Based on the description of gingival inflammation in children and the role of ascorbic acid for tissue health, the writer is interested in conducting a study “The Influence of Administering Ascorbic Acid on Children Experiencing Gingival Inflammation in Students Class I-VI of SDIT Ar-Rahmah Makassar”.

Materials and Method

This type of research is experimental research with a pretest-posttest design with a control group with a purposive sampling technique. Examination to get children who have erupted gingivitis was carried out on all students of class I-VI SDIT Ar-Rahmah and obtained 30 children who met the inclusion and exclusion criteria. After informed consent was made, the initial examination was conducted to select students who had erupted gingivitis and then the gingival index value was measured in the student. The samples obtained were divided into two groups, namely the group of children given ascorbic acid and the control group who were not given ascorbic acid. Gingival inflammation is measured using the gingival index at the time before administration of ascorbic acid, one week, and two weeks after administration of ascorbic acid. Measurements were made in both the treatment and control groups. The statistical test used was Repeated ANOVA test.

RESULTS

The results of the study are presented in table form as follows.

Table 1: Average distribution of gingival index values before consuming ascorbic acid, at 1 week of consumption of ascorbic acid, and at 2 weeks of consumption of ascorbic acid

<table>
<thead>
<tr>
<th>Sample characteristics</th>
<th>Value of gingival index before vitamin C consumption (Pre)</th>
<th>Value of gingival index after 1 week of consuming vitamin C (Post 1)</th>
<th>Value of gingival index after 2 weeks of consuming vitamin (Post 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Average</td>
<td>Average</td>
</tr>
<tr>
<td>Intervention group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>0.99820,48629</td>
<td>0.93750,29599</td>
<td>0.80650,26080</td>
</tr>
<tr>
<td>Control</td>
<td>1.19170,33027</td>
<td>1.10280,39806</td>
<td>1.04160,40853</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 years</td>
<td>0.75000,40020</td>
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<td>V</td>
<td>1.45830,12910</td>
<td>1.02010,35476</td>
<td>0.92410,3573</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.02500,48917</td>
<td>0.94440,40663</td>
<td>0.82490,43530</td>
</tr>
<tr>
<td>Female</td>
<td>1.1640,34037</td>
<td>1.09580,28822</td>
<td>1.02320,23235</td>
</tr>
<tr>
<td>Total</td>
<td>1.09490,42012</td>
<td>1.02010,35476</td>
<td>0.92410,3573</td>
</tr>
</tbody>
</table>

Based on the intervention group, there is a decrease in the average gingival index value in the treatment and control groups.
Based on age, the average gingival index value in the 8 year age group is 0.7500 in Pre period, 0.7963 in Post 1 period, and 0.7592 in Post 2 period. The average gingival index value in the 9 year age group namely 1.2098 in the Pre period, 1.1295 in Post 1 period, and 0.9330 in the Post 2 period. The gingival index means in the 10 year age group it is 1.3086 in the Pre period, 1.0893 in Post 1 period, and 1.1180 in Post 2 period.

Based on the class, the average gingival index score in class III is 0.7969 in Pre period, 0.8646 in Post 1 period, and 0.7916 in Post 2 period. The average gingival index in class IV is 1.1077 in Pre period, 1.0117 in Post 1 period, and 0.8733 in Post 2. The average gingival index score in class V is 1.0949 in Pre period, 1.0201 in Post 1 period, and 0.9241 in Post 2 period.

Based on sex, the average gingival index score in male students is 1.0250 in Pre period, 0.9444 in Post 1 period, and 0.8249 in Post 2 period. The average gingival index score in female students is 1.1648 in Pre period, 1.0958 in Post 1 period, and 1.0232 in Post 2 period.

Table 2: Percentage of gingivitis severity in the treatment and control groups before consumption of ascorbic acid (Pre-test)

<table>
<thead>
<tr>
<th>Gingivitis interpretation</th>
<th>Treatment</th>
<th>Control</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
<td>%</td>
<td>11</td>
</tr>
<tr>
<td>Pre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild Gingivitis</td>
<td>8</td>
<td>53,3</td>
<td>6</td>
</tr>
<tr>
<td>Moderate Gingivitis</td>
<td>7</td>
<td>46,7</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100,0</td>
<td>15</td>
</tr>
<tr>
<td>Post 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild Gingivitis</td>
<td>12</td>
<td>80,0</td>
<td>7</td>
</tr>
<tr>
<td>Moderate Gingivitis</td>
<td>3</td>
<td>20,0</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100,0</td>
<td>15</td>
</tr>
<tr>
<td>Post 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild Gingivitis</td>
<td>12</td>
<td>80,0</td>
<td>7</td>
</tr>
<tr>
<td>Moderate Gingivitis</td>
<td>3</td>
<td>20,0</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100,0</td>
<td>15</td>
</tr>
</tbody>
</table>

The results of the statistical test in the Pre period (before consumption of ascorbic acid) between the treatment and control groups showed that there was no significant difference between the gingival index scores in the two intervention groups (p> 0.05). The results of the statistical test in the Post 1 period (one week of consumption of ascorbic acid) between the treatment and control groups showed that there was no significant difference between the gingival index scores in the two intervention groups (p> 0.05). The results of the statistical test in the Post 2 period (two weeks of consumption of ascorbic acid) between the treatment and control groups showed that there was no significant difference between the gingival index scores in the two intervention groups (p> 0.05).

Table 3: Score comparison of gingival index between each period of intra measurement treatment group

<table>
<thead>
<tr>
<th>Period</th>
<th>Period Compared</th>
<th>Average Difference</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>Post 1</td>
<td>0,061</td>
<td>0,556*</td>
</tr>
<tr>
<td></td>
<td>Post 2</td>
<td>0,192</td>
<td>0,064*</td>
</tr>
<tr>
<td>Post 1</td>
<td>Post 1</td>
<td>-0,061</td>
<td>0,554*</td>
</tr>
<tr>
<td></td>
<td>Post 2</td>
<td>-0,131</td>
<td>0,018**</td>
</tr>
<tr>
<td>Post 2</td>
<td>Pre</td>
<td>-0,192</td>
<td>0,064*</td>
</tr>
<tr>
<td></td>
<td>Post 1</td>
<td>-0,131</td>
<td>0,018**</td>
</tr>
</tbody>
</table>

Table 3 shows the results of the further difference test between each intra-period measurement of the treatment group. There is no significant differences (p> 0.05) between the results of measurements of the
gingival index value between Pre and Post periods 1. There is no significant differences (p> 0.05) between the results of measuring the gingival index value between Pre and Post 2 periods. Significant difference (p <0.05) between the results of measuring the gingival index value between Post 1 and Post 2 periods.

Table 4: Score comparison of gingival index between each period of intra measurement of the control group

<table>
<thead>
<tr>
<th>Period compared</th>
<th>Average difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>Post 1</td>
<td>0.089</td>
</tr>
<tr>
<td></td>
<td>Post 2</td>
<td>0.150</td>
</tr>
<tr>
<td>Post 1</td>
<td>Pre</td>
<td>-0.089</td>
</tr>
<tr>
<td></td>
<td>Post 2</td>
<td>-0.061</td>
</tr>
<tr>
<td>Post 2</td>
<td>Pre</td>
<td>-0.150</td>
</tr>
<tr>
<td></td>
<td>Post 1</td>
<td>-0.061</td>
</tr>
</tbody>
</table>

Further difference test (Least Significant Difference): p < 0.05 not significant

Table 4 shows the results of the further difference test between each intra-period measurement of the control group. There is no significant differences (p> 0.05) between the results of measurements of the gingival index value between the Pre and Post 1 periods. There is no significant differences (p> 0.05) between the results of measuring the gingival index value between Pre and Post 2 periods. There is a significant difference (p< 0.05) between the results of measuring the gingival index value between Post 1 and Post 2 periods.

Table 5: Score comparison of gingival index in pre, post 1, and post 2 periods between the treatment and control groups (inter intervention group)

<table>
<thead>
<tr>
<th>Period</th>
<th>Group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Control</td>
</tr>
<tr>
<td>Averages.b</td>
<td>Averages.b</td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>0.99820,48629</td>
<td>1,19170,33017</td>
</tr>
<tr>
<td>Post 1</td>
<td>0.93750,29599</td>
<td>1,10280,39806</td>
</tr>
<tr>
<td>Post 2</td>
<td>1,04160,40873</td>
<td></td>
</tr>
</tbody>
</table>

ANOVA Repeated Test: P<0.05 significant

Table 5 shows a decrease in the average value of the gingival index in both the treatment and control groups. From the results of the statistical test, p value = 0.022 (p <0.05) means that there is a significant difference in the gingival index score between the treatment group and the control group in Pre measurement period (before ascorbic acid consumption), Post 1 (one week of consumption of ascorbic acid), and Post 2 (two weeks consumption of vitamin C).

Table 6: Score comparison of gingival index between each measurement period in the treatment and control groups (inter intervention group)

<table>
<thead>
<tr>
<th>Period compared</th>
<th>Average difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>Post 1</td>
<td>0.075</td>
</tr>
<tr>
<td></td>
<td>Post 2</td>
<td>0.171</td>
</tr>
<tr>
<td>Post 1</td>
<td>Pre</td>
<td>-0.075</td>
</tr>
<tr>
<td></td>
<td>Post 2</td>
<td>-0.096</td>
</tr>
<tr>
<td>Post 2</td>
<td>Pre</td>
<td>-0.171</td>
</tr>
<tr>
<td></td>
<td>Post 1</td>
<td>-0.096</td>
</tr>
</tbody>
</table>

Further difference test : p > 0.05 not significant
Further difference test : p < 0.05 significant

Table 6 shows the results of the further difference test between each measurement period. There is no significant differences (p> 0.05) between the results of measurements of the gingival index value between Pre and Post period 1. There is significant differences (p <0.05) between the results of measuring the gingival index value between Pre and Post 2 periods. There is a significant difference (p <0.05) between the results of measurements of the gingival index value between Post 1 and Post 2 periods.

Discussion

In this study, the average gingival index value of male students is lower than female students in each examination period (Table 1). This result was different from the results of research conducted by Rania Rodan, et al. (2015) and Vijaya Sharva et. al. (2014) 23,24 In both studies, boys had higher plaque values and gingival scores than women. This different result might be due to the irregular brushing habits of female students compared to male students who were sampled in the study.

Comparison of the gingival index value between the treatment group and the control group at each examination period showed no significant difference between the Pre-control and treatment groups, Post 1
control group and treatment group, and Post 2 period control group and treatment group (Graph 1). Based on the results of this study, there is significant differences in the comparison of the gingival index score between the treatment group and the control group (p = 0.022). In further comparisons between each measurement period, a comparison of the gingival index score between Pre-Post 2 period (p = 0.011) and Post 1-Post 2 (p = 0.041) had significant differences (Tables 5 and 6). That is, there is an effect of ascorbic acid on eruption gingivitis experienced by students in the treatment group compared to students in the control group. The changes seen were a decrease in the gingival index value and there were significant differences compared to the control group not given ascorbic acid.

Jacob et al. (1987) examined the effects of food rotation with lack of ascorbic acid, normal, and supplemented in subjects with healthy periodontal conditions. Their results showed that the tendency of the gingiva to become inflamed or bleeding on probing was reduced after consuming ascorbic acid. Ascorbic acid plays an important role in collagen synthesis. Alvares and Siegel (1981) reported an increase in gingival tissue permeability in animals with food deficiencies containing ascorbic acid and this change due to the development of sciatric gingivitis. This shows that the permeability of harmful substances from bacteria on the surface of the epithelium increases, allowing easier entry into the periodontal tissue. Ascorbic acid may play a role in reducing the permeability of the gingival epithelium and avoiding penetration of this toxic substance into periodontal tissue.

Conclusion

It can be concluded that there is an effect of giving ascorbic acid to children with erupted gingivitis in students class I-VI SDIT Ar-Rahmah. There are significant differences between the gingival index mean values between the treatment group (given ascorbic acid) and the control group (not given ascorbic acid). That is, there is an effect of ascorbic acid on eruption gingivitis experienced by students in the treatment group compared to students in the control group.

Ascorbic acid has a relationship with the health of periodontal tissue and has various functions for periodontal tissue. Ascorbic acid is an antioxidant that plays a role in counteracting free radicals from the results of cell metabolism in the body, as a cofactor in the process of forming proline and lysine which is an amino acid forming collagen, and stimulating increased activity of the body’s defense cells.

Conflict of Interest: There is no conflict of interest in this study.

Source of Funding: Domestic government

Ethical Clearance: This study obtained a label of ethics escaped by the number: 0067/PL09/KEPKFKG-RSGMUNHAS/2018 and register number UH 171 20068 on Oktober 9, 2018.

REFERENCES


Awareness toward Energy Drinks among Tikrit University Students

Nisreen M. Ibraheem¹, Mayada K. Mohammed¹

¹Family & Community Medicine Department, Tikrit Medical College, Tikrit University, Iraq

ABSTRACT

Background: Energy drinks related to a group of products, in form of liquid, which mainly consist of caffeine, which may contain other added dietary supplements. These drinks may be one cause of serious side effects if used in large doses or for long period especially in children, adolescents, diabetics or patients with certain diseases like heart disease.

Subject and Method: The study is cross-sectional conducted in in Tikrit University from 20th November 2017 to 31st of March 2018. The sample of 300 students were chosen by clusters then simple random sampling was chosen from each cluster. Data were collected by self administered questionnaire. Data were presented and analyzed statistically.

Results: This study found that 61% of the students in the sample did not recognize the energy drinks. The percentage of energy drinks consumers was 12% with male predominance. Most common reasons behind energy drink consumption were to improve concentration and wakefulness (64% of consumers). Most of the students that do not drink the energy drinks either because they do not know what are these drinks (in 34%) or because of their fear of being addicted to them (in 20%).

Conclusions: Energy drinks awareness and its effects between Tikrit University students is poor. A considerable percentage of students drink the energy beverages and the most common reasons were to increase concentration and improve wakefulness. The students do not drink these beverages mostly either because they do not know what are these drinks or their fear of being addicted to them.

Keywords: Energy drinks, university students

Introduction

Energy drinks are caffeine contained liquid, sometimes dietary supplements may be added. The first appearance of these drink was in the United State in 1949 and was named as “Dr. Enuf” (¹). First appearance in Europe was at 1987; after that the spread overall the world, being very common after appearance of Red Bull in 1997 (²). From that time, the energy drink shops has grown rapidly, under different names all over the world. The yearly using of energy drinks in 2013 was more than 5.8 billion liters in nearly 160 countries (³). Markers of these drinks lastly have shifted their consumer from athletes to youth individuals. Energy drinks are mainly increased in areas with teenagers and youth individuals. Most of energy drink users are 13–35 years old, and males are two thirds of the consumer (⁴). On the united states, energy drinks become number two of most common liquid supplement used by youth individual; nearly thirty percent of energy drinkers take drinks on a regular basis (⁵). The wide usage of energy drinks in Saudi Arabia does not appear to differ from that in the world. (⁶) Energy drinks are prepared to give an “energy enhancement” to the customer by gathering of stimulants and energy boosters. Caffeine is the major content of the most energy drinks. Mostly these drinks contain 80–150 mg of caffeine per 8 ounces. (⁷) Most studies have tested the behavioral effects of energy drinks that contain caffeine, glucose, and vitamins in its contents (⁸). The studies found improvements in aerobic and anaerobic cycling performance, attention performance and/or reaction time tasks (⁹), afternoon driving performance, (¹⁰) and different indices of alertness (⁸, ⁹, ¹⁰). Energy drinks consist of 75 mg caffeine and glucose (¹¹). The gathering of caffeine with glucose in these drinks may give restorative properties (¹²). In a study they given energy drink which mainly contain glucose to 11 tired persons who accept.
To be volunteered who examined in a driving simulator, marked enhancement was seen in lane drifting after two hours post drinking\textsuperscript{(13)}. Other study has been examined the early effects of these drink on cognitive activities.

The findings showed that they decrease both reaction times on the behavioral control tasks as well as ratings of mental fatigue, whereas it increased subjective ratings of stimulation\textsuperscript{(14)}. On the other hand, although the above pointed studies have been shown the positive effects of energy drinks on exercise performance, other studies not found important effects or health side effects. A single blind placebo Al-fares et al study\textsuperscript{(15)} lastly examined the roles of energy drinks on exercise works in 32 healthy females. The finding was that drinking of these fluids just before exercise will not causes any changes in the indices of physical performance, that included time to exhaustion, maximum oxygen consumption, blood pressure, pulse rate, and capillary oxygen saturation. This agree with observation founded in a double blind, placebo controlled cross over study of fifteen active persons. The finding of this study that there is no effect of energy drinks on ride time to exhaustion or pulse rate. No changes seen in rating of exertion \textsuperscript{(16)}. Evaluation of the acute effects of energy drinks on exercise performance was tested on 19 professional female volleyball players\textsuperscript{(17)}.

**Subjects and Method**

The current work is crosssectional study, it was achieved in Tikrit university in Salah Al-Deen governorate in Iraq from 20\textsuperscript{th} November 2017 to 31\textsuperscript{st} of March 2018. Sample included 300 students (150 male and 150 female) who chosen by cluster sampling then simple random sampling chosen from each cluster (college). Data collection was done by self administered questionnaire that include (age, sex, college, marital state, type of energy drinks, cause of drinking, amount, withdrawal symptoms, benefits of energy drinks, attention to contents list, if not drinking give reason). Data analysis, management and presentation: Collected data presented by simple tables and figures then analyzed statistically.

**Results**

The results found that 184 (61\%) of students does not recognize energy drinks, and literature college students had higher frequency about 24(80\%). But 116 (39\%) of students recognize it and pharmacy college students had higher frequency about 18(60\%) as in figure 1.

![Figure 1: Recognition of energy drinks by students](image1)

Regarding the ideas of students about role of energy drinks on health, this study revealed that 26(8.7\%) students said it’s good, 94(31.3\%) students said it’s not good, and 180(60\%) students do not know. As in figure 2.

![Figure 2: The student's opinion on energy drinks if they were beneficial to health](image2)

The reason behind energy drinking in populations as the students think, the results revealed that 167(41\%) students think that it “promote wakefulness”, 57(14\%) of them think that it “help in staying aware in night”, 51(13\%) of them think that the reason is “refreshment/taste”, 12(3\%) of them think that the reason is “weight loss”, 66(16\%) of them think that it “attract from advertisement”, 50(13\%) of them think that it “relief stress”. as in figure 3.

![Figure 3: The reasons behind energy drinking in populations as the students think](image3)
About searching for information about energy drinks, 226 (75%) of students say No and 74 (25%) of them say Yes from them 66 students search in “internet” and 8 students “ask friends”, as in figure-4.

![Figure 4: Searching for information about energy drinks](image)

The relation between students’ performance and energy drinks consumption demonstrated in fig. 5 and fig. 6.No.as well as percentages in table three.

![Figure 5: Students’ performance in consumers](image)

![Figure 6: Students’ performance in non-consumers](image)

About reasons for don’t drinking energy drinks among students, 91(34%) of students didn’t know about it, 21(8%) of students say that it has a bad taste, 52(20%) of students fear from addiction, 25(10%) of students say that it interrupts diet, 23(9%) of them say that it is a parents’ instructions, and 51(19%) of them say that they know about undesirable effects of energy drinks as in fig. 7.

![Figure 7: Reasons of not consuming energy drinks by students](image)

About undesirable effects of energy drinks that happened to consumer students, it is demonstrated in figure-8.

![Figure 8: side effects of energy drinks that happened to consumer students](image)

**Discussion**

The aim of this survey was the evaluation of the consumption and awareness of Tikrit university students about energy drinks. The study was found that only 39% of all sampled students where recognized the energy drinks, in comparison with other study made at the Prince Sattam Bin-Abdulaziz university in Saudi Arabia, the percentage was much higher (94% of all sampled students) [18]. About 180(60%) of students out of 300 did not know whether energy drinks good to human health or not, 94 students (31.3%) said that these...
drinks are not good to human health, in comparison with the same study of Saudi Arabia mentioned above, 68% of drinking students did not know whether these drinks are good or not and 31.4% of consumers did not recommend the use of energy drinks. Most common reason behind drinking energy drinks by population (by students’ opinion) was to promote wakefulness (41%); this reason is the most common one as mentioned by most literatures.

Regarding performance among energy drinks consuming students, the result shows that 49% had had intermediate performance, 35% had had good performance, and only 11% had had very good performance. Comparing these percentages with figure-7 which shows the performance of non-consuming students, in which 19% had had very good results, 29% had had good results, and 30% had had intermediate results. Comparing of these finding suggest no significant improvement of study performance when use of energy drinks. A study about the role of energy drinks on cognitive improvement also had concluded the same results. The most common reasons were that the students don’t know what are the energy drinks (34%) and fear of becoming addicted to these drinks (20%). one study about the energy drinks and impact of caffeine on neurophysiology, “many caffeine consumers proclaim that they are addicted to the substance”, however the evidence is inconsistent. On the other hand, another study about the caffeine use disorders shows that caffeine can cause clinical addiction as it recognized by the WHO. The most common side effects of energy drink are headache and palpitation. This agree with study done in Australia 2010 which found that most side effects are palpitation, tremor, headache. A study done in Saudi Arabia found that 29% of the sample have crash episode, 22% suffer from severe headache and 19% undergone from tachycardia while they have drinking drinks.

Conclusions

1. The energy drinks awareness and its effects among Tikrit University students was poor.
2. A considerable percentage of students drink the energy beverages and the most common reasons were to increase concentration and improve wakefulness especially during exams.
3. The largest percentage of students did not drink these beverages mostly either because they do not know what are these drinks or their fear of being addicted to them.
4. The side effects associated with these drinks were very common with headache, palpitation, mood swings and dental carries were the most commonly documented.

Recommendations

1. Increase the number of awareness campaigns regarding the negative effects of energy drinks, which are becoming more prevalent in university through extension courses.
2. Parents have an important role to play in controlling their children’s consumption of energy drinks.
3. Minimize the import of energy drinks by giving sufficient information to the Ministry of Commerce and the concerned parties concerned with importing foodstuffs.
4. Increase taxes on shops and markets that sell energy drinks in general, and markets and cafeterias that offer their goods to college students and universities in particular.
5. Determine the places of sale of energy drinks and restricting the social groups consumed by restricting their sale, especially for children and others vulnerable groups.

Ethical Clearance: From research ethic committee in Tikrit university/college of medicine

Source of Funding: Self

Conflict of Interest: Nill

References


Mitral Valve Prolapse Diagnosis and Incidence

Noori Odah Madhee¹, Sameerah Rashid Jabbar¹, Mohammed Hassan Baghdadi², Ali Khalid Abood¹, Hayder Adnan Fawzi³

¹Department of Cardiac Surgery, ²Head of Department, Department of Cardiology, Ibn Al-Bitar Teaching Hospital, Baghdad, Iraq; ³Baghdad Medical City, Baghdad Teaching Hospital, Clinical Pharmacy Department, Baghdad, Iraq

ABSTRACT

Objective: determine the incidence of mitral valve prolapse using echocardiographic criteria

Materials and Method: this study involved 117 symptomatic patients, aged between 17 – 42 years, these patients examined in the outpatients’ clinic of Baghdad teaching hospital (Iraqi cardiac center) and Ibn Al-Nafees Hospital by the use of 2D echocardiography.

Results: The most common presenting symptoms was palpitation, the prevalence of MVP was 8.55%, anterior leaflet was the most involved (50%), non-classical leaflet morphology was more common than classical (70%), the frequency of female was higher than male for patients with MVP. There was no significant difference in LA, LVEDD and EF in patients with MVP according to age group

Conclusion: The prevalence of mitral valve prolapse was slightly higher than reported in international studies 8.55%, the prevalence in females more than males.

Keywords: mitral valve, prolapse, female, leaflet, echocardiographic criteria

Introduction

Mitral valve prolapse (MVP) is a common cause of mitral regurgitation (MR). Although most patients with MVP have mild, trivial, or no MR. MVP is the most common cause of surgical MR in developed countries. Other potential complications include infective endocarditis and arrhythmias. The diagnosis of MVP is suspected on physical examination and confirmed by echocardiography².

The diagnosis of mitral valve prolapse (MVP) was previously based upon a combination of clinical exam findings and echocardiographic criteria; the current definition relies on imaging alone. The current imaging definition of MVP is billowing of any portion of the mitral leaflets ≥2 mm above the annular plane in a long axis view (parasternal or apical three-chamber). Prolapse of the mitral valve is defined as an abnormal systolic displacement of one or both leaflets into the left atrium (systolic billowing) due to a disruption or elongation of leaflets, chordae, or papillary muscles³.

The prevalence of mitral valve prolapse (MVP) in the general population varies among studies, mostly due to variable criteria used for diagnosis. Reports published early in the development of echocardiography suggested high MVP prevalence, 4 to 10 percent and even close to 20 percent in selected populations. These early reports are now considered inaccurate because echocardiographic criteria for diagnosis were not yet fully developed and lacked specificity⁴⁻⁶. Using currently accepted definition of MVP, the Framingham Heart Study reported an overall prevalence of 2.4 percent⁷. MVP may be slightly more common in women than in men. In the Framingham study, there was a nonsignificant trend toward a female preponderance among those with MVP (59.5 versus 52.7 percent in those without MVP)⁷. The objective of the current work to determine the incidence of mitral valve prolapse using echocardiographic criteria.
Method

Study Design and Setting: A prospective observational study conducted in the Department of in the outpatients’ clinic of Baghdad teaching hospital (Iraqi cardiac center) and Ibn Al-Nafees Hospital during the period from 1st February 2012 to 1st July 2012.

Total number of 117 patients presented with variable symptoms (palpitation, chest pain, shortness of breath, fatigue, and syncope), all were evaluated clinically and echocardiography.

Diagnosis of MVP: MVP diagnosed according to the criteria purposed by Harvey Feigenbaum:

1. Upword (posterior) displacement (≥2mm beyond the annular plane of the MV leaflets, single or both leaflets or even segment (scallop) of any MV leaflet towards the LA in systole.

2. An increase in the thickness of the prolapsed MV leaflet (3-5 mm for the non-classical MVP, and >5 mm for the classical MVP).

Additionally LA size, LVEDD, and EF were assessed using the linear method.

Results

The most common presenting symptoms was palpitation, the prevalence of MVP was 8.55%, anterior leaflet was the most involved (50%), non-classical leaflet morphology was more common than classical (70%), the frequency of female was higher than male for patients with MVP, as illustrated in table 1.

Table 1: Assessment of maternal and neonatal characteristic

<table>
<thead>
<tr>
<th>Variables</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presenting symptoms, n (%)</td>
<td></td>
</tr>
<tr>
<td>Palpitation</td>
<td>68 (58.1%)</td>
</tr>
<tr>
<td>Chest pain</td>
<td>14 (12.0%)</td>
</tr>
<tr>
<td>SOB</td>
<td>6 (5.1%)</td>
</tr>
<tr>
<td>Fatigue</td>
<td>20 (17.1%)</td>
</tr>
<tr>
<td>Dizziness, syncope</td>
<td>9 (7.7%)</td>
</tr>
<tr>
<td>MVP</td>
<td>10 (8.55%)</td>
</tr>
<tr>
<td>MVP features</td>
<td></td>
</tr>
<tr>
<td>Leaflet involvement</td>
<td></td>
</tr>
<tr>
<td>Anterior</td>
<td>5 (50%)</td>
</tr>
<tr>
<td>Posterior</td>
<td>3 (30%)</td>
</tr>
<tr>
<td>Bileaflets</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>Leaflet morphology</td>
<td></td>
</tr>
<tr>
<td>Myxomatous (classical)</td>
<td>3 (30%)</td>
</tr>
<tr>
<td>Non- Myxomatous (non-classical)</td>
<td>7 (70%)</td>
</tr>
<tr>
<td>Mild mitral regurgitation</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>Associated lesions</td>
<td></td>
</tr>
<tr>
<td>ASD secondum</td>
<td>1 (10%)</td>
</tr>
<tr>
<td>HCM</td>
<td>1 (10%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>7 (70%)</td>
</tr>
<tr>
<td>Male</td>
<td>3 (30%)</td>
</tr>
</tbody>
</table>

MVP: mitral valve prolapse, SOB: shortness of breath, ASD: atrio-septal defect, HOCM: hypertrophic cardiomyopathy

There was no significant difference in LA, LVEDD and EF in patients with MVP according to age group, as illustrated in table 2.
Table 2: Assessment of echocardiographic parameters according to age for patients with MVP

<table>
<thead>
<tr>
<th>Variables</th>
<th>17-28 years</th>
<th>29-42 years</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>3</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>LA (mm), mean ± SD</td>
<td>32.78 ± 6.32</td>
<td>33.76 ± 7.25</td>
<td>0.845</td>
</tr>
<tr>
<td>LVEDD (mm), mean ± SD</td>
<td>49.21 ± 8.12</td>
<td>51.69 ± 5.23</td>
<td>0.571</td>
</tr>
<tr>
<td>EF (%), mean ± SD</td>
<td>65.28 ± 10.8</td>
<td>64.3 ± 8.31</td>
<td>0.879</td>
</tr>
</tbody>
</table>

Discussion

Prevalence of MVP in general population varies among studies, mostly due to variable criteria used for the diagnosis. Studies based on tertiary care centers may have attracted more symptomatic patients than those who seek medical attention at smaller medical centers, thus trials performed at these centers may have overestimated the true prevalence of symptomatic patients with mitral valve prolapse.

The current study which had been done in two tertiary centers revealed the prevalence of MVP as 8.55%, this high frequency can be attributed to the high number of cardiac cases visiting these centers. Other studies showed lower rates of MVP like Freed et al with incidence (4%)\(^6\), in Devereux et al study MVP was (1.8%)\(^7\), also Theal et al found that the prevalence of MVP was 2.3%\(^8\), this low rate of MVP can be attributed to the rigid diagnostic criteria for MVP, and differences in the examined criteria\(^7\).

Conclusion

The prevalence of mitral valve prolapse was slightly higher than reported in international studies 8.55%, the prevalence in females more than males.

Conflict of Interest: None

Ethical Clearance: Informed written consent was obtained from all the participants in the study, and the study and all its procedure were done in accordance with the Helsinki Declaration of 1975, as revised in 2000. The study was approved by department of cardiology in Baghdad teaching hospital and Ibn Al-Nafees Hospital.

Source of Funding: The work were supported by authors only

REFERENCES


Effect of Two Separated Doses of Antenatal Steroids at 32 Weeks and Five Days Before Delivery in Prevention of Neonatal Respiratory Distress Syndrome

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¹Department of Obstetrics and Gynecology, ²Department of Pediatrics, College of Medicine, Nahrain University

ABSTRACT

Objective: examine the effect of two separated dose (32 weeks and 5 days before delivery) on the occurrence of respiratory distress syndrome.

Materials and Method: A case control study has been applied from 17th September 2017 to 19th of July 2018 in Imamain Al-Kathimain medical city, involved 188 premature baby delivered by elective cesarean section, the mothers divided into two groups group A (96 women) that received two doses of steroid (at 32 weeks, and 5 days before delivery) and group B (94 women) that receive one dose of steroid at 32 week of gestation respectively.

Results: there was slight increase in number of female in both group, total number of them in group A was 52 (54%), and total number of male was 44 (64%) while in group B it was 49 (53%) and 43 (47%) respectively. The study show significant decrease in number of premature suffering from respiratory distress syndrome in group A 29 (30%) than in group B 58 (63%), there was no statistical significant differences regarding those who were admitted in neonatal intensive care because of respiratory distress syndrome in form of respiratory rate, heart rate, and days of hospitalization.

Conclusion: two separated doses of steroid at 32 weeks of gestation and 5 days before delivery are more superior to one dose of steroid in prevention of respiratory distress syndrome.

Keywords: respiratory distress syndrome, premature, antenatal steroid, heart rate, hospitalization

Introduction

Respiratory distress syndrome occurs primarily in premature infants, its incidence is inversely related to gestational age and birth weight, it occurs in 60-80% of infants <28wk of gestational age, in 15-30% of those between 32 and 36 wk of gestational age and rarely in those >37 wk of gestational age. The risk of development of RDS increases with maternal diabetes, multiple birth, cesarean delivery, precipitous delivery, asphyxia, cold stress and maternal history of previously affected infants.

Respiratory distress syndrome (RDS) affects about 1 percent of newborn infants and is the leading cause of death in babies who are born prematurely². About 12 percent of babies born in the United States are preterm, which is higher than in other developed countries³. The risk of RDS rises with increasing prematurity. Babies born before 29 weeks of gestation have a 60 percent chance of developing RDS⁴, but babies born at full term rarely develop this condition. Maternal risk factors for preterm birth include previous preterm birth, periodontal disease, low maternal body mass, poor prenatal care, poverty, being uninsured, and being a member of a minority group⁵.

Further study on infant respiratory distress syndrome (RDS) found that the deficiency of surfactant was a consequence of either insufficient production by the immature lungs or a genetic mutation in one of the surfactant proteins, SP-B. The rarer genetic form of the
disease is not associated with premature birth and occurs in full-term babies\textsuperscript{6}.

A surfactant system facilitating inflation stability, decreasing the work of breathing and contributing to the innate host defense of the lungs\textsuperscript{7}. Among preterm singletons, antenatal corticosteroid administration is a well-established strategy for the reduction in the rate of respiratory distress syndrome\textsuperscript{8}.

The standard dosage of antenatal corticosteroids is equivalent to the amount of endogenous cortisol that would be released in response to stress in the untreated premature neonate who develops RDS. The first 12-mg dose of betamethasone achieves 75\% corticosteroid receptor saturation. Consequently, the standard dose of antenatal corticosteroids results in a near maximal induction of corticosteroid receptor-mediated response in fetal target tissues\textsuperscript{9, 10}. Prematurely born infants have to use their lungs for gas exchange at the end of the canalicular stage and during the saccular stage. As a life-saving measure, many of them receive surfactant, steroids, or oxygen and are mechanically ventilated, causing damage at the cellular level due to oxygen toxicity and volutrauma. In addition, these infants have to cope with pulmonary inflammation and a steroid-induced re-programming lung development. As a result, alveolarization does not progress as well as in term-born infants. The resulting disease is called bronchopulmonary dysplasia (BPD). Infants showing BPD have fever and therefore larger alveoli, insufficient vascularization and airflow limitations. All of these conditions cause a reduction of gas exchange in its own right. BPD-induced alterations of the lungs often persist into adulthood or throughout the whole life\textsuperscript{11}.

**Method**

**Study Design and Setting:** A case-control study was conducted in Imamain Al-Kathimain medical city during a period from 17\textsuperscript{th} September 2017 to 19\textsuperscript{th} of July 2018 and involved 188 premature baby delivered by elective cesarean section, they were divided into two groups. group A, the mothers receive two corticosteroid when she was 32 weeks of gestation and additional dose of steroid five days before delivery in addition to usual dose. This is of particular importance because the benefits of antenatal corticosteroids in singletons are greatest between 2 and 7 days after administration\textsuperscript{12}, and group B the mothers in this group receive only usual dose of steroid at 32 weeks of gestation and after delivery by cesarean section, the neonate of both group where followed and clinical evaluation was done in neonatal intensive unit of the same medical city and any neonate diagnosed as having respiratory distress syndrome were admitted in this unit for management and follow up, and other neonate who are well and beginning feeding were discharging home. Those who were admitted to intensive care unit receive usual treatment of RDS and follow by daily measure of respiratory rate and heart rate every four hours to evaluate the deference between two groups in regarding response to treatment in order to see weather prenatal steroid has any effect on treatment of neonate suffering from RDS after delivery.

**Exclusion Criteria:** Any neonate with possibility of congenital infection, congenital anomalies or dysmorphic feature were excluded from the study.

**Statistical Analysis:** Chi-square was applied to test differences between proportion, and p-value <0.05 was considered significant, all analysis carried out using SPPS software package version 22.0.

**Results**

The frequency of RDS was significantly higher in group B compared to group A, as illustrated in table 1.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group A</th>
<th>Group B</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>96</td>
<td>92</td>
<td>-</td>
</tr>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>52 (54.2%)</td>
<td>49 (53.3%)</td>
<td>0.901</td>
</tr>
<tr>
<td>Male</td>
<td>44 (45.8%)</td>
<td>43 (46.7%)</td>
<td></td>
</tr>
<tr>
<td>RDS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>29 (30.2%)</td>
<td>58 (63.0%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Negative</td>
<td>67 (69.8%)</td>
<td>34 (37.0%)</td>
<td></td>
</tr>
</tbody>
</table>

RDS: respiratory distress syndrome

There was no significant difference in the rate of respiratory rate, heart rate and hospitalization of infant between both group A and B, as illustrated in table 2.
Table 2: Assessment of neonatal outcomes in neonate with positive RDS according to treatment

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group A</th>
<th>Group B</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>29</td>
<td>58</td>
<td>-</td>
</tr>
<tr>
<td>Respiratory rate, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 – 69</td>
<td>3 (10.3%)</td>
<td>7 (12.1%)</td>
<td>0.947</td>
</tr>
<tr>
<td>70 – 79</td>
<td>7 (24.1%)</td>
<td>15 (25.9%)</td>
<td></td>
</tr>
<tr>
<td>≥80</td>
<td>19 (65.5%)</td>
<td>36 (62.1%)</td>
<td></td>
</tr>
<tr>
<td>Heart rate (beat/min), n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110 – 120</td>
<td>4 (13.8%)</td>
<td>7 (12.1%)</td>
<td>0.918</td>
</tr>
<tr>
<td>121 – 130</td>
<td>20 (69.0%)</td>
<td>39 (67.2%)</td>
<td></td>
</tr>
<tr>
<td>131 – 140</td>
<td>5 (17.2%)</td>
<td>12 (20.7%)</td>
<td></td>
</tr>
<tr>
<td>Hospitalization (days), n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3 (10.3%)</td>
<td>9 (15.5%)</td>
<td>0.926</td>
</tr>
<tr>
<td>4</td>
<td>15 (51.7%)</td>
<td>29 (50.0%)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>9 (31.0%)</td>
<td>16 (27.6%)</td>
<td></td>
</tr>
<tr>
<td>&gt;5</td>
<td>2 (6.9%)</td>
<td>4 (6.9%)</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Respiratory distress syndrome is a frequent neonatal emergency worldwide with reported prevalence rates of 4.24% in Pakistan13, 18.5% in France14, 23% and in Ivory Coast15. It is a frequent emergency and causes high morbidity and mortality. Most of its risk factors and etiologies are preventable. Adequate follow-up of pregnancy and labor for timely intervention may improve the neonatal outcomes16.

This study show that the number of female was slightly more than the number of males which is similar to the percentage of female and male that were delivered in hospital in this period which was 56% (413) of female and 44% (324) males from the total 737 live birth.

The most important thing in this study is the significant effect of two separated doses giving to mother who are at risk of preterm delivery on usual dose recommended by the American College of Obstetrician and Gynecologist call for a single course of corticosteroids to all pregnant women between 24-34 weeks of gestation who are at risk for preterm delivery17.

So in our study we want to accelerate the pulmonary maturity in cases of fetal that delivered after 34 weeks to potentially reduce the likelihood of RDS when preterm delivery is indicated. and we choose to give the second dose of steroid 5 days before delivery because they found that, there is particular importance to give corticosteroid 2-7 days before delivery because there is greatest effect of corticosteroid between 2 and 7 days12. This study show no effect of the two separated doses of steroid on the management of RDS that occur post-nataly which indicate absence of effect of postnatal steroid on prognosis of RDS.

Conclusion

Two separated dose of steroid at 32 weeks of gestation and 5 days before delivery decrease significantly the occurrence of respiratory distress syndrome in premature delivery by elective caesarian section.

Conflict of Interest: None

Ethical Clearance: Informed written consent was obtained from all the participants in the study, and the study and all its procedure were done in accordance with the Helsinki Declaration of 1975, as revised in 2000. The study was approved by department of Gynecology and Obstetrics at Imamain Al-Kathimain medical city.

Source of Funding: The work were supported by authors only

REFERENCES


Pulmonary Tuberculosis Disease: Prevention Behavior in Makassar City

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¹Department of Health Analyst, ²Department of Nutrition, Makassar of Health Polytechnic, Indonesia

ABSTRACT

The problem of pulmonary tuberculosis in the world and in Indonesia is very worrying due to the high mortality and morbidity rate, especially Indonesia is a tropical country so that it can reduce the public health development index. This study aims to determine the effect of knowledge on the behavior of prevention of pulmonary tuberculosis in Makassar City, Indonesia. The sample referred to in this study is that some of the people who have suffered pulmonary disease and who do not suffer from pulmonary tuberculosis who live in the working area of the Makassar City Health Center are 335 people. The sampling technique uses multi stage random sampling. Data analysis using regression test. The results of the analysis are presented in the form of tables, charts and narratives. The results showed that knowledge of disease source control, knowledge of controlling disease agents, knowledge of increasing endurance had a significant influence on the behavior of prevention of pulmonary tuberculosis in the community (p <0.05).

Conclusion: community knowledge can improve the behavior of preventing pulmonary disease in the community.

Keywords: pulmonary tuberculosis, knowledge, behavior, prevention.

Introduction

The Government’s commitment in reducing tuberculosis cases in Indonesia has issued the Decree of the Minister of Health of the Republic of Indonesia Number: 364/Menkes/SK/V/2009 concerning guidelines for the prevention of tuberculosis which refers to the Directly Observed Treatment Short-course (DOTS) strategy and is implemented in all regions of Indonesia. The DOTS strategy consists of 5 key components, namely: 1) Political commitment, with increasing and continuing funding. 2) Case finding through quality microscopic examination of phlegm. 3) Standard treatment, with supervision and support for patients. 4) Effective management system and availability of antituberculosis drugs. 5) Record and reporting monitoring system that is able to provide an assessment of the results of patient treatment and program performance. But the problem of tuberculosis in Indonesia is still a serious problem because the case is still high and attacks all age groups¹,².

The incidence of tuberculosis cases with acidic (+) bacilli in South Sulawesi Province (2013) reported a total of 8,902 cases in the male population of 5,259 cases (59.08%) and in female sex 3,643 (40.92 %). The Makassar City Health Office’s Disease Prevention and Health Improvement Field (2014), the number of new patients with pulmonary tuberculosis TB (+) in 2013 was 72.44% (found 1,811 patients out of 2,500 targets), this number increased from 2012 with 1,324 patients out of 1,641 targets. When compared to the 2013 target of 70%, the achievement level exceeds the target with a achievement percentage of 72.44%³,⁵,⁸.

Research results related to the above interactions include Media Y reporting that the people of Padang Panjang City have a relatively good level of knowledge about tuberculosis, but some still think that the causes of pulmonary tuberculosis are related to things that are unseen and because offspring; public perception that the disease that is dialysis is a normal cough, so that it is associated with a lack of caring attitude towards the

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effects of pulmonary tuberculosis; and the behavior and awareness of some people to check phlegm and use health care facilities is still lacking. States that health behavior (health behavior) is a person’s response to stimuli or objects related to health-sickness, illness, and factors that affect health-sickness (health) such as the environment, food, drink, and service health. In other words, health behavior is all activities or activities of a person that can be observed (observable) or that cannot be observed (unobservable) related to the maintenance and improvement of health. Based on the explanation above, the objectives to be achieved from this study are a description of behavior on prevention of lung tuberculosis in Makassar City, knowledge of controlling disease sources, controlling disease agents, and increasing patient’s resistance to tuberculosis prevention behavior and knowledge variables the dominant influence on the behavior of preventing pulmonary disease in the people of Makassar City.

**Material and Method**

Based on the research design that will be used, the type of research is an analytical survey. The population referred to in this study are all people who are domiciled in the area of Makassar City, both healthy and sick or suffering from tuberculosis disease that has been diagnosed by a doctor. The sample intended in this study were some of the people who had suffered from tuberculosis and who did not have pulmonary tuberculosis who lived in the working area of the Makassar City Health Center as many as 335 people. Sampling in this study is a multi stage sampling technique that is a method of sampling through stages. There are also techniques as follows:

a. The first stage, using all sub-districts within the city of Makassar, is 14 sub-districts. b. The second stage is to determine the number of samples for each sub-district by comparing the number of cases of pulmonary tuberculosis to the total population of lung tuberculosis Acid Resistant (+) multiplied by the number of samples to be studied (335 subject), c. The third stage, from the sub-district determined by the Puskesmas which has the highest number of cases of pulmonary tuberculosis as a place for collecting data. In this study, the variables to be analyzed consisted of dependent variables, namely lung disease prevention behavior and independent variables, namely knowledge of controlling tuberculosis disease sources, knowledge of controlling tuberculosis disease agents and knowledge of increasing body resistance to tuberculosis disease. The analysis technique in this study, used is a simple regression test and multiple regression at an error rate of 5%.

**Findings**

**Multivariate Analysis:** This analysis aims to determine the effect of Knowledge Source Disease Control variables, Knowledge Variables for Disease Control Agents and Knowledge of Increasing Body Resilience variables on the Behavior Prevention of Tuberculosis Transmitted Disease variables in Makassar City by using multiple regression test analysis. The results of the study are as follows:

1. The Effect of Knowledge on the Control of Sickness Sources of Behavior in Lung Tuberculosis Prevention in Makassar City People

Table 1: Anova Results of the Influence of Knowledge on Sources of Disease, Against Community Behavior of Makassar City in Prevention of Lung Tuberculosis in 2016

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>94.647</td>
<td>1</td>
<td>94.647</td>
<td>605.094</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>52.087</td>
<td>333</td>
<td>.156</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>146.734</td>
<td>334</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: behavior

Table 1. Shows that p <0.05, null hypothesis is rejected, and alternative hypotheses are accepted. This means that Knowledge Knowledge of the Resource Sources variable influences the variable of Lung Disease Prevention Behavior in Makassar City community.
2. Influence of Knowledge on Agent Control of Disease Against Preventive Pulmonary Disease Behavior in Makassar City Community

Table 2: Anova Results of the Influence of Knowledge on Agent Control of Diseases Against the Behavior of Makassar City People in Prevention of Lung Tuberculosis in 2016

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Regression</td>
<td>63.667</td>
<td>1</td>
<td>63.667</td>
<td>255.226</td>
</tr>
<tr>
<td>Residual</td>
<td>83.068</td>
<td>333</td>
<td>.249</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>146.734</td>
<td>334</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Behavior

Table 2. shows that p <0.05, null hypothesis is rejected, and alternative hypotheses are accepted. This means that the Knowledge Variables of Pulmonary Tuberculosis Agent Controlling Influence on the variables of the Prevention of Lung Tuberculosis in Makassar City.

3. The Effect of Knowledge of Increasing Body Endurance Against the Prevention of Pulmonary Disease Behavior in Makassar City People

Table 3: results of the Analysis of the Effect of Knowledge of Increasing body Endurance control on Makassar city community behavior in the Prevention of Lung Tuberculosis in 2016

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Regression</td>
<td>80.420</td>
<td>1</td>
<td>80.420</td>
<td>403.831</td>
</tr>
<tr>
<td>Residual</td>
<td>66.314</td>
<td>333</td>
<td>.199</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>146.734</td>
<td>334</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: behavior

Table 3 shows that p <0.05, null hypothesis is rejected, and alternative hypothesis is accepted. This means that the knowledge variable for increasing body endurance has an effect on the variable behavior of preventing pulmonary tuberculosis in Makassar.

4. Knowledge of Prevention of Infectious Diseases of Highly Infected Pulmonary Diseases Against the Behavior of the People of Makassar City in the Prevention of Lung Disease

Table 4: Results of Analysis of Correlation of Knowledge on control of Sickness Sources, Knowledge of control of Disease Agents, and Knowledge of Increasing body Endurance Against behavior of Lung Disease Prevention in Makassar City Society

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>Knowledge of Source of Disease Control</th>
<th>Knowledge of Agent Control of Diseases</th>
<th>Knowledge of increasing body endurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior</td>
<td>.948</td>
<td>.867</td>
<td>.900</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 4. shows that the effect of Knowledge of Source Disease Control on Prevention of Pulmonary Disease Behavior with a value of r = 0.948, Effect of Knowledge of Disease Control Agents on Prevention of Pulmonary Disease Behavior with a value of r = 0.867, and knowledge of increasing body resistance to prevention behavior of tuberculosis Lung with a value of r = 0.900. Based on the coificient correlation, it can be concluded that the biggest contribution of influence is Knowledge of Source of Disease Control, followed by Knowledge of Increasing Endurance of the Body, and finally Knowledge of Agent Control of Disease.
Discussion

1. The Effect of Knowledge on the Control of Tuberculosis Sources on the Preventive Behavior of Lung Tuberculosis in the City of Makassar: Based on the results of the research in table 2 above, it can be concluded that the knowledge of controlling the source of tuberculosis disease affects the behavior of tuberculosis tuberculosis prevention in Makassar City community. The results of this study, in line with some of the research results reported include: Hamidi H. (2010), in the results of his research suggesting that there is a relationship between knowledge of pulmonary tuberculosis prevention and the incidence of tuberculosis in children aged 0-14 years of Salatiga City community. Stated that knowledge of drug consumption was related to the compliance of patients taking medicine for pulmonary tuberculosis in the Glugur community in Medan.

Furthermore reported that there was a correlation between respondents’ knowledge and the behavior of preventing lung tuberculosis in the community in the Maleran Medan Waterfall Village.

Based on the description above, it can be concluded that the behavior of preventing tuberculosis of the people of Makassar City is influenced by the knowledge of tuberculosis pulmonary disease prevention from the aspect of controlling the source of the disease. Knowledge of controlling the source of disease is all efforts to control the source of pulmonary tuberculosis that is known by the people of Makassar City so that the community can prevent transmission of pulmonary tuberculosis.

The control knowledge in question is: if the sick community will go to the doctor and at health care facilities such as clinics, health centers and hospitals; Do not sleep in a room with people with pulmonary tuberculosis; know the clinical symptoms of pulmonary tuberculosis; know how to transmit pulmonary tuberculosis; knowing that if treatment is interrupted then pulmonary tuberculosis cannot heal; knowing that pulmonary tuberculosis germs can be turned off using antibacterial both physical and chemical; knowing that the development of pulmonary tuberculosis germs is related to unhealthy home environment sanitation and so on.

2. Effect of Knowledge on the Control of Agents of Pulmonary Tuberculosis. Pulmonary Disease Prevention of Pulmonary Disease in Makassar City Community: The results of the study showed that the Knowledge of Pulmonary Tuberculosis Control Agent Agents had an effect on the Lung Disease Prevention Behavior of the people of Makassar City. The results of this study are also in line with the results of several studies that have been reported, among others: in the results of his research suggesting that there is a relationship between knowledge of tuberculosis prevention and the incidence of tuberculosis in children aged 0-14 Salatiga City. States that knowledge of drug consumption is related to patient compliance with the drug TBc Lung from the Glugur Medan community. Furthermore reported that there was a relationship between respondents’ knowledge and the behavior of pulmonary tuberculosis prevention in the Kelurahan Medan Maleran Waterfall. Based on the description above, it can be concluded that the behavior of preventing tuberculosis of the people of Makassar City is influenced by the knowledge of preventing tuberculosis from aspects of controlling the disease agent.

Knowledge of controlling disease agents is all efforts to control lung tuberculosis agents known by the people of Makassar so that the community can prevent transmission of tuberculosis. The control knowledge in question is: Knowledge of the Makassar city community referred to in this study include the causes of tuberculosis, transmission of tuberculosis, bacterial habitat for tuberculosis disease, how to destroy tuberculosis, germs of tuberculosis and so on.

3. Effect of Knowledge on Increasing the Body Resilience of Pulmonary Tuberculosis Against the Prevention of Pulmonary Disease in the People of Makassar City: The results of table 4 show that Knowledge of Increasing Body Endurance influences the Prevention of Lung Tuberculosis Behavior in Makassar City community. The results of this study are also in line with some of the reported research results, among others: in his research there is a relationship between knowledge of tuberculosis disease prevention with the incidence of tuberculosis.
in children aged 0-14 years of Salatiga City community\textsuperscript{2,7,11}. States that knowledge of drug consumption is related to patient compliance with the drug TBc Lung from the Glugur Medan community. Furthermore, reported that there was a relationship between the knowledge of respondents and the behavior of prevention of lung disease in the community in the Medan Maleran Waterfall Village\textsuperscript{12}.

Based on the description above, it can be concluded that the behavior of prevention of tuberculosis in the people of Makassar City is influenced by the knowledge of preventing tuberculosis from aspects of increasing body resistance to tuberculosis. Knowledge of increasing endurance is an effort to increase the body’s resistance to tuberculosis, which is known to the people of Makassar so that the community can prevent transmission of tuberculosis. The knowledge of increasing the body’s resistance in question is: protecting themselves from the spread of tuberculosis disease, consuming food, healthy drinks, managing good household waste, the dangers of cigarettes to health, eradicating disease vectors, healthy environmental sanitation, adequate rest, the influence of stress on health, the benefits of exercise for the human body and so on\textsuperscript{4,11,14}.

**Conclusion**

Based on the results of research and discussion in this study, it can be concluded that the description of the behavior of tuberculosis pulmonary disease prevention in general is good category, knowledge of controlling tuberculosis pulmonary disease affects the behavior of tuberculosis pulmonary disease prevention in Makassar, influential knowledge of tuberculosis disease control agents on the behavior of preventing lung tuberculosis in Makassar City, the knowledge of increasing body resistance to tuberculosis has an effect on the behavior of tuberculosis tuberculosis in Makassar City, the variable that greatly influences tuberculosis prevention behavior in Makassar is the knowledge of Tuberculosis disease control., then the knowledge of increasing body resistance to tuberculosis disease, and finally the control knowledge of tuberculosis disease agents.

**Conflict of Interest:** Between subjects and researchers does not have a conflict of interest.

**Source of Funding:** The source of funding comes from the 2018 Budget Project Entry List of the Makassar of Health Polytechnic, Indonesia.

**Ethical Clearance:** The research ethics was obtained from the Research Ethics Commission of the Makassar of Health Polytechnic with No. 237/KEPK-PTKMKS/VII/2016.

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Prevalence and Indications of Caesarean Section in Karbala Gynecology and Obstetrics Teaching Hospital, Iraq

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ABSTRACT

Objective: To determine the frequency of cesarean section and analyze the indications, so as to introduce measures to control the cesarean section rate as decreasing this rate will lessen the maternal morbidity and mortality

Patients and Method: This cross sectional study was conducted in Karbala Gyn & Obst Teaching Hospital from 1st of August 2018 to 31st of December 2018, it is a tertiary hospital in the province. In this study information and data were taken from all the patients underwent cesarean section. Calculation of the total no of deliveries was done and the rate of cesarean section was devaluated with the indications of them.

Results: The total number of women have been delivered over the study period was 9414, out of which caesarean sections (CS) were 2471. The prevalence of caesarean section in the study population was 26.2%. The most common indication of caesarean section was previous caesarean section (67.7%), followed by Fetal distress (8.29%), failure of progress in labour (6.43%) and breech presentation (5.66%).

Conclusion: The rising prevalence of caesarean section was mainly due to previous caesarean section followed by Fetal distress, also we did our study in tertiary hospital this means that most of the risky cases will be admitted to it so the rate is 26.2%.

Keywards: cesarean section, indications, Karbala province

Introduction

Caesarean section (CS) is the process whereby the baby is delivered from the uterus by direct incision through the abdominal wall and the uterus, the first caesarean section was done in 16th century.

The WHO rate the cesarean section to be considered between 10-15% to be the optimal needed goal for the life saving for the mother and her fetus but this rate is still rising. It has associated with increase maternal mortality and morbidity. this rising rate because few hospitals except teaching hospitals provide peer review for diagnosis of failure of progress of labor, trail of labor with low-segment caesarean section is not always accepted, also vaginal deliveries are not much supported, no accurate diagnosis of fetal distress by using fetal PH scalp, there is powerful incentive for both physician and hospitals by unhealthy medico-legal climate.

In recent years the rate of caesarean section reaches to 46% in some record in china, 25% or above of them performed on request, followed by Vietnam and Thailand with 36% and 34% respectively with lowest in India 18%, Latin America and USA about to be similar around 30-40%, the prevalence is 9% in Africa.

In Arabic countries the rate of cesarean section is as follow; four countries had a CS rates less than 5% (Yemen, Sudan, Mauritania and Algeria), but three countries have the incidence of CS above 15% (Lebanon, Qatar and Bahrain), and the other countries have CS rate in the range of 5-15% which are (Palestine, Oman, Morocco, Libya, Tunisia, Saudi Arabia, United Arab of Emirate, Egypt, Jordan, Kuwait and Syria).
Caesarean section is done either as emergency operation or an elective one. The indications of elective caesarean section include cephalopelvic disproportion, placenta Previa some malpresentation e.g. breech presentation & transverse lie. Emergency caesarean section may be needed because of antenatal complication as pre-eclampsia, abruptio placenta (with a baby still alive), fetal distress or failure to progress in labor. \(^7\)

The incidence of caesarean section was increased all over the world and became one of most common procedures in maternity hospitals and because this rate has increased dangerously in last few years with its increased morbidity, so caesarean section must be performed when there are solid indications, some obstetrician consider it is simple and safe and superior to operative vaginal delivery as forceps and vacuum. \(^8\)

There is controversy over the rate of caesarean section is gaining on benefit of higher or lower rate of caesarean section, but WHO recommended there is no additional health benefit associated with caesarean section rate above 10%-15%. The WHO stated, on the basis of a study of maternal and fetal complications between 2004 and 2008 in 24 countries, that cesarean sections are associated with an increase in risks for both mother and child compared to vaginal delivery and should therefore be performed only when significant advantages are expected. \(^9\)

In spite of increase rate of caesarean section, the 4 major causes of caesarean section are; fetal distress, previous caesarean section, breech, failure of progress of labor. Effective implementation of strategies to reduce caesarean section rate depend on social and cultural media associated belief and practice of society. \(^10\)

**Patients and Method**

This is a cross sectional study conducted from 1st August 2018 to 1st of January 2019, to observe the cesarean delivery rate and various indicators contributing to it, at Karbala Gyn & Obst Teaching Hospital/Karbala province. This is a tertiary referral hospital, with about 20,000 deliveries yearly.

The total no. of women delivered in the study period was 9414 having all live births, 2471 of them were delivered by CS, the rest delivered vaginal which was 6943 women, verbal consent was taken from each patient enrolled in the study, data by an interview was collected with each one. In cases of caesarean sections, the data includes demographic parameters like age, cause of caesarean section, no. of caesarean section and residence urban/rural, geographical distribution, whether procedure was done as an emergency or it was an elective one. Previous obstetrics history and present obstetric parameters like antenatal care, gestational age (weeks), were also recorded in the format.

The various categories of indications for caesarean sections included Previous CS scar, Breech presentation, Failure of progress, Pre-eclampsia, Postdate, Infertility, Fetal distress, Twin pregnancy, Malpresentation, APH (Antepartum hemorrhage), CPD (Cephalopelvic Disproportion), Cord prolapse and bad obstetrical history.

Total primary and repeat caesarean deliveries were calculated. The caesarean rate was calculated in form of percentage and later data was analyzed by SPSS (version 22).

**Results**

The total no. of deliveries in the study period was 9414, 2471 out of which had delivered via C-Section. The overall C-Section rate was 26.2%. The rate of primary CS was 30%. About 49.98% of the CS were done as an emergency procedure and 50.02% were elective one (Table 1).

<table>
<thead>
<tr>
<th>Mode of delivery</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal delivery</td>
<td>6833</td>
<td>74.3</td>
</tr>
<tr>
<td>Cesarean section delivery</td>
<td>2471</td>
<td>25.7</td>
</tr>
<tr>
<td>Total no of deliveries</td>
<td>9414</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary/Repeat</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary section</td>
<td>742</td>
<td>30</td>
</tr>
<tr>
<td>Repeat section</td>
<td>1729</td>
<td>69.97</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of C-section</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency CS</td>
<td>1235</td>
<td>49.98</td>
</tr>
<tr>
<td>Elective CS</td>
<td>1236</td>
<td>50.02</td>
</tr>
</tbody>
</table>

Maximum no. of C-sections was in the age group of 20-25 year (54.9%) followed by (31.7%) patients in the age group of 31-40 years. These two groups constituted
nearly 86.6% of total C-Sections. Only 4.77% of the cases belonged to the elderly age group of above 40 years. when study the type of previous of caesarean sections it shows maximum no. of C-sections was previous 1 CS (30%). while minimum no. of C-sections was more than 4 CS (5.58%) (table 2).

Table 2: Demographic analysis of patients who underwent C-Section

<table>
<thead>
<tr>
<th>Age group</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20 Years</td>
<td>220</td>
<td>8.9</td>
</tr>
<tr>
<td>20-30 years</td>
<td>1357</td>
<td>54.9</td>
</tr>
<tr>
<td>31-40 years</td>
<td>785</td>
<td>31.7</td>
</tr>
<tr>
<td>&gt;40 years</td>
<td>118</td>
<td>4.77</td>
</tr>
</tbody>
</table>

Frequency of CS

| Previous 1 CS   | 742          | 30  |
| Previous 2 CS   | 521          | 21  |
| Previous 3 CS   | 274          | 11  |
| Previous 4 CS or more | 138 | 5.58 |

Among the indications of cesarean section, it was observed that Previous C-section scar (67.7%) was the commonest cause followed by fetal distress (8.29%), Failure of progress (6.43%), Breech (5.66%) and preeclampsia (2.54%) (Table 3).

Table 3: Indications of cesarean section

<table>
<thead>
<tr>
<th>Causes</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous CS scar</td>
<td>1673</td>
<td>67.7</td>
</tr>
<tr>
<td>Breech</td>
<td>140</td>
<td>5.66</td>
</tr>
<tr>
<td>Failure of progress</td>
<td>159</td>
<td>6.43</td>
</tr>
<tr>
<td>preeclampsia</td>
<td>63</td>
<td>2.54</td>
</tr>
<tr>
<td>Post date</td>
<td>49</td>
<td>1.98</td>
</tr>
<tr>
<td>Infertility</td>
<td>62</td>
<td>2.5</td>
</tr>
<tr>
<td>Fetal distress</td>
<td>183</td>
<td>7.4</td>
</tr>
<tr>
<td>Twin pregnancy</td>
<td>18</td>
<td>0.72</td>
</tr>
<tr>
<td>Male presentation</td>
<td>17</td>
<td>0.68</td>
</tr>
<tr>
<td>APH</td>
<td>39</td>
<td>1.57</td>
</tr>
<tr>
<td>CPD</td>
<td>33</td>
<td>1.33</td>
</tr>
<tr>
<td>Cord prolapse</td>
<td>6</td>
<td>0.24</td>
</tr>
<tr>
<td>Bad obstruct history</td>
<td>17</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Out of 2471 caesarean deliveries in the study group, 87.85% were from the center of Karbala city. (Table 4).

Table 4: Distribution of cesarean section according to the geographical distribution

<table>
<thead>
<tr>
<th>Location</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ein Al-Tamur (periphery)</td>
<td>9</td>
<td>0.36</td>
</tr>
<tr>
<td>Al-Hindya (periphery)</td>
<td>42</td>
<td>1.69</td>
</tr>
<tr>
<td>Al- Hussainya (periphery)</td>
<td>183</td>
<td>7.4</td>
</tr>
<tr>
<td>Outside of Karbala city</td>
<td>66</td>
<td>2.67</td>
</tr>
<tr>
<td>Center of Karbala city</td>
<td>2171</td>
<td>87.85</td>
</tr>
</tbody>
</table>

Among the indications of the cesarean sections in relation to the period of gestation (GA), it was observed that the maximum no. of C-sections was in the gestational age of 37-41 weeks (95.9%) as it is shown in (table 5).

Table 5: Percentage of C-section in relation to the period of gestation (GA)

<table>
<thead>
<tr>
<th>Gestation age (weeks)</th>
<th>No. of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;41 weeks</td>
<td>59</td>
<td>2.38</td>
</tr>
<tr>
<td>37-41 weeks</td>
<td>2370</td>
<td>95.9</td>
</tr>
<tr>
<td>&lt;37 weeks</td>
<td>42</td>
<td>1.69</td>
</tr>
</tbody>
</table>

Discussion

The total no. of deliveries in the Obst. & Gyn Hospital in Karbala, is between 20,000-22,000/yr., the caesarean section rate in our study was 26.2%. The WHO recommended that the rate of C-section should be within 10–15%, this study showed a higher rate as compared to the advised rate. The rising caesarean section rate is a worldwide phenomenon, as in United State Brazil and Chili the rates were 26.1% and 27% and 40% respectively, however, the primary caesarean section usually determines the future obstetrical course of any woman and therefore should be avoided wherever possible. 11, 12, 13

There are many studies done in different places in Iraq, Jarjees. Y14, found that the incidence of cesarean section in Al Batool maternity hospital in Mosul, Iraq was 17.95%.

In our study, most of mothers who delivered by cesarean section were in the 20–30 and 31–40 years’ age group (54.9%) and (31.7%), respectively. These results were contrary to what was explained in a study conducted by Lin et al15, and Raja et al16, on the association between the age of the patient and cesarean sections, they found...
that the more the age of patients the more the caesarean section rate, this results are explained on proposed that physiological factors related to aging may account for the high number of CS among older women, in our current study we found that there is increased incidence of cesarean sections at 20-30 years similar to the results found by Ratan et al. 

Regarding studying the no. of previous of cesarean sections in the study sample, we found that maximum no. of C-sections was found in patients with previous 1 CS (30%) and the minimum number was in those with previous 4 CS or more (5.58%). These results were same to what was found in a study conducted 2014 by Hafeez et al and Ratan et al and, by Sreetama et al, where they found that the most common cause for cesarean section in their study was previous scar about 22.76%, 29.96% and 31.8% respectively, also we found in our study that the primary cesarean section deliveries form about 30% of all operations different from what Ratan et al found as there were 63.41%, and about similar to Naeem et al.

The most important indication for performing emergency CS was previous CS scar (67.7%) followed by fetal distress (8.29%) and Failure of progress (6.43%) this is similar to what was concluded by Hamida M. et al, as there was 70.49% had previous cesarean scar fetal distress 2.49% and CPD 35.31% our findings were different from Naeem et al, as fetal distress was the leading indication for cesarean section, this may be explained by the previously scarred uterus need close follow up in labour and the admission of patients to Karbala hospital is considered to be high monthly and so the teams and turnover of the women in labour is high. In addition, the lack of fetal blood sampling techniques in this hospital was not available so they depend on fetal monitoring by CTG and color of liquor to conduct suspicion of fetal distress. Other indications in our study were breech presentation (5.66%), Hypertension (2.54%), Infertility (2.5%).

Out of the 2471 caesarean deliveries, 87.85% were from the center of Karbala which is comparable to Hamida M et al as there was 61.7% at the inside of the city in her study. An acceptable ratio of the patient living in areas (outside the center of the city) where have lack of awareness about risk and complications of caesarean section, people are extremely poor, family size is large, they do not believe and follow an antenatal care and consider caesarean birth is safe rapid process, they bring their ladies to the hospital when they are seriously ill and with complications. Those who support this trend point to reduced perinatal morbidity and mortality, but others suggest that a complex medico-legal factors underlie the rise.

Previous caesarean delivery is important Cause of cesarean delivery. And therefore Perform the vaginal delivery experience after a previous cesarean section should be performed in order to control the growing cesarean delivery rate.

In our study Pregnancy-induced hypertension was found in 2.54% of caesarean section cases, while Ratan et al, had 4.87% this cause in his study. Good prenatal care discover such early problems and early management of complications can be prevented and hence the mode of delivery would be different.

In our study (table 5), we have most of the cases delivered at term, i.e. between 37-41 weeks of gestation and this is the acceptable gestation for delivery as most of the causes for cesarean section was previous scar and in labour.

Conclusion

The caesarean section prevalence in our study was 26.2% considering that because our hospital is tertiary one. The rising prevalence of caesarean section was mainly due to previous caesarean section followed by Fetal distress. Certain measures have been recommended to curtail the increasing trend, so we aim to reduce the primary cesarean section and follow guidelines in labour, conducting good antenatal care programs and also advice for having good fetal monitoring system.

Conflict of Interest: this study can be of benefit for the departments belong to Ministry of Health and The Ministry of Higher Education and Scientific Research/ Republic If Iraq.

Source of Funding: Self supplements.

Ethical Clearance: approval is taken from the Karbala Health Directorate and Karbala teaching hospital of gynecology and obstetrics, and verbal permission from women to conduct research.
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Health Knowledge of Outpatient Visitors at Mirjan Teaching Hospital in Al-Hilla City

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¹Family Medicine Specialist, ²Internal Medicine, Al Muthanna University, College of Medicine, Iraq; ³Family Medicine Specialist, Babylon Health Directorate, Babylon, Mirjan Teaching Hospital, Iraq

ABSTRACT

Background: Little health knowledge is related to absence of medical data, inadequate use of protective methods, low drug loyalty rates, elevated health care fees and elevated hazard of hospitalization. This study was aimed to confirm the broad health knowledge of outpatient visitors at Mirjan Teaching Hospital in Al-Hilla city.

Method: A cross-sectional descriptive study using convenience sample that consisted of 300 patients who were visiting the outpatient clinic in Mirjan Teaching Hospital. Simple demographic data were collected. SPSS (version 22) was used for statistical analysis, Chi-squared test was used for nonparametric variables.

Results: Data from current study showed that 64% of participants had poor knowledge and 36% had good knowledge. In addition, results revealed that 46 (15%) of participants were 15-24 years, 118 (40%) were 25-44 years and 36 (45%) were ≥45 years. Also, 138 (46%) of participants were males and 54% (162) were females. Moreover, 46% (140) of participants were living in urban areas; whereas 54% (160) were from rural regions. Illiterate patients represented 14%, those with primary education 37%, those had high school 30%, while those had higher education (university or institute) 19% of the total number of participants.

Conclusions: Poor health knowledge was more dependent on level of education of patients, but did not depend on age, gender or area of residence.

Keywords: Health knowledge, gender, age, area of residence, level of education.

Introduction

Health knowledge is a word presented in the 1970s and of growing meaning in community health and healthcare. It is anxious for the abilities of individuals to see the difficult requests of health in the current civilization. Health knowledgeable means insertion one’s individual health and one’s public and family into the background, accepting which elements are manipulating it, and seeing how to report them. A person with an acceptable degree of health knowledge has the capacity to take duty for one’s personal health as well as one’s domestic health and public health. It is vital to differentiate health knowledge from knowledge in overall.

Knowledge is not simply mentioning to person conversion, but besides to background and social conversion in relations of health knowledge to the cost-effective development and socio-cultural and governmental variation.

Knowledge to health, display a relationship between little knowledge and reduced drugs devotion, information of illness and self-care treatment services.

To maintenance, this method, mentions 4 parts for study: health knowledge test; successful interaction with low-knowledge patients; prices and results of deprived health knowledge; and causative ways of how deprived health knowledge stimulate health.

Health knowledge has grown information, inspiration, and capabilities to admission, know, judge, and put on data in daily life to make rulings and conclusions in health maintenance, illness avoidance, and well performances that continue and encourage excellence of lifecycle.

Sufficient health knowledge allows healthy surroundings, well-organized health policy, actual health encouragement attempts, well self-care with fewer health hazards, well health maintenance consequences, and lesser health maintenance prices.
The survey is concentrated on gauging health knowledge not just in clinical surroundings, but also in residents and public [10].

This study was aimed to confirm the broad health knowledge of outpatient visitors at Mirjan Teaching Hospital in al Hilla city.

Method

A cross-sectional descriptive study I conducted during the period from November 2017 to April 2018 in Hilla city/Iraq. The study recruited a convenience sample consisted of 300 patients who visited outpatient clinics at Mirjan Teaching Hospital. The questionnaires were filled during interviews with patients for 10 to 15 min. The questionnaire consisted of 18 questions derived from short version of the Test of Functional Health Literacy in Adults (S-TOFHLA), The Single Item Literacy Screener (SILS) and the Newest Vital Sign (NVS) [11,12]. It was translated to Arabic language by a translation that used official procedure by [13,14]. A pilot study with 25 patients was directed to evaluate any vague declarations or requests. In addition, reliability analyses were organized for the questionnaire using Cronbach’s alpha (0.6), which signifies the inner dependability of questions. Simple demographic data (i.e. age, gender, educational level and living place) were collected, as well. The answers to questions either “yes” or “no” so we gave 1 score for “yes” answer and 0 score for “no” answer. A total sum of scores from 0-9 represented poor knowledge, while ≥9 represented fair/good knowledge. We used SPSS version 22 for statistical analysis, Chi-squared test for nonparametric variables and the P-value<0.05 represented a significant test.

Results

The total number of patients included in the study was 300; all of them responded to the questionnaire and answered all questions. They were 64% with poor knowledge and 36% were with good knowledge. In addition, data from current study revealed that the sociodemographic criteria of participants were as follows:

1. Age: According to age, participants were divided into 3 categories; 15-24 years (46 (15%)), 25-44 years (118 (40%)) and ≥45 years (136 (45%)).

2. Gender: The males 138 and represented 46% of participants, while females were 162 and represented 54% of participants.

3. Place of living: Participants who lived in urban regions were 140 (46%); whereas those from rural regions were 160(41%).

4. Education level: Participants were 41(14%) illiterate, 111(37%) had primary education, 91(30%) had high school education and 57(19%) were university or institute graduate.

Knowledge and age: When we crosstab knowledge scores with ages of patients, the results showed that approximately 64% of them had poor knowledge and 36% had good knowledge. Those aged≥45 represented 31% of those with poor knowledge, while those aged (25-44) represented 17% of those with good knowledge. Level of knowledge did not correlate with age (P>0.05; Table 1).

Knowledge and Gender: when we crosstab knowledge scores with the gender of patients, results of current study showed that 64% of them had poor knowledge and 36% had good knowledge. Also, 35% of females had poor knowledge and 17% of males had good knowledge. Level of knowledge did not depend on gender (P>0.05; Table 2).

Knowledge and Place of Living: When we crosstab knowledge score with a place of living of patients, results of current study showed that 36% of patients lived in rural areas had poor knowledge, whereas 19% of patients lived in the urban areas had good knowledge. Little knowledge did not depend on the place of living (P>0.05; Table 3).

Table 1: Association between participants’ knowledge and age

<table>
<thead>
<tr>
<th>Knowledge Scale</th>
<th>Age group/year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15-24</td>
<td>25-44</td>
</tr>
<tr>
<td>Scale</td>
<td>No. (%)</td>
<td></td>
</tr>
<tr>
<td>Poor (0-9)</td>
<td>33 (11.0)</td>
<td>66 (22.0)</td>
</tr>
<tr>
<td>Fair-Good (≥9)</td>
<td>13 (4.3)</td>
<td>52 (17.3)</td>
</tr>
<tr>
<td>Total</td>
<td>46 (14)</td>
<td>118 (40)</td>
</tr>
</tbody>
</table>

P>0.05 (not significant)

Table 2: Association between participants’ knowledge and gender

<table>
<thead>
<tr>
<th>Knowledge Scale</th>
<th>Gender</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>Scale</td>
<td>No. (%)</td>
<td></td>
</tr>
<tr>
<td>Poor (0-9)</td>
<td>87 (29.0)</td>
<td>104 (34.7)</td>
</tr>
<tr>
<td>Fair-Good (≥9)</td>
<td>51</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td>138 (46)</td>
<td>162 (54)</td>
</tr>
</tbody>
</table>

P>0.05 (not significant)
Table 3: Association between participants’ knowledge and place of living

<table>
<thead>
<tr>
<th>Knowledge Scale</th>
<th>Place of living</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban</td>
<td>Rural</td>
</tr>
<tr>
<td>Poor (0-9)</td>
<td>84(28.0)</td>
<td>107(35.7)</td>
</tr>
<tr>
<td>Fair-Good (≥9)</td>
<td>56(18.7)</td>
<td>53(17.7)</td>
</tr>
<tr>
<td>Total</td>
<td>140(36)</td>
<td>160(64)</td>
</tr>
</tbody>
</table>

P≥0.05 (not significant).

Knowledge and Education Level: when we crosstab knowledge scores with education levels of patients, results showed that 25% of patients were with primary education and had poor knowledge, whereas 13% of patients with higher school education had good knowledge. Little knowledge significantly depended on educational level (P<0.05; Table 4).

Table 4: Association between participants’ knowledge and educational level

<table>
<thead>
<tr>
<th>Knowledge Scale</th>
<th>Educational Level</th>
<th>Total No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Illiterate</td>
<td>Primary Education</td>
</tr>
<tr>
<td></td>
<td>No. (%)</td>
<td></td>
</tr>
<tr>
<td>Poor (0-9)</td>
<td>40 (13.3%)</td>
<td>75 (25.0%)</td>
</tr>
<tr>
<td>Fair-Good (≥9)</td>
<td>1 (0.3%)</td>
<td>36 (12.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>41 (14)</td>
<td>111 (37)</td>
</tr>
</tbody>
</table>

P<0.05 (significant).

Discussion

The aim of the study was to evaluate health knowledge of outpatient visitors at a Teaching Hospital in Babylon governorate in Iraq.

So in the current study, poor health knowledge represented 64% of all visitors and good knowledge represented 36% of all visitors. Previous Iranian and American studies showed that 30.3% and 17.8% of their subjects had inadequate health knowledge [15,16].

According to the age of visitors, the age group (45 years and above) represented 31% of participants with poor knowledge. Similar results were reported by [17,18]. While 17% of subjects with good knowledge were aged (25-44) years, [19] reported that 49% of their subjects had good level of knowledge.

According to gender, current study showed that 35% of females had poor knowledge and 17% of males were with good knowledge with no relation between gender and low health knowledge. Similar results were reported by a Lebanon study with no relationship between gender and low knowledge [20]. Other studies showed that 52% of males with good knowledge and 48% of females with good knowledge with significant relationship [21-23].

According to the place of living, the current study showed that 36% of participants lived in rural areas were with poor health knowledge 36%, while only 19% of urban-lived people had good health knowledge. This finding maybe due to the fact that rural areas had inadequate entree to health care and those in rural areas are underserved by primary attention doctors [24,25]. Many rural persons must travel considerable distances for primary medical maintenance than their city complements [20].

According to the level of education, the current study showed that 25% of patients with primary education and had poor knowledge, while 13% of patients with high school education had good knowledge with the significant relation between good knowledge and educational level. These data were in agreement with other studies [20-22].

Limitations: This was the initial survey of health knowledge in Mirjan Teaching Hospital in Al-Hilla city, and that added challenges to conduct the research. The collection of outpatient visitors was by convenience sample. Therefore, the outcomes are not generalizable and may not relate to other outpatient visitors in Iraq. The participation was unpaid. Pharmacy customers who refused to participate might have low health literacy. The random sample would be suggested for forthcoming studies.
Conclusion

While additional investigation is needed to measure health knowledge level and its social elements among a wider and more different Iraqis population. Low health knowledge is more dependent on level of education of patients who visited the hospital, but the low knowledge did not depend on patients’ gender, area of living or age of participants.

Acknowledgements

We would like to thank Abdul-kadhai kadhom daham who helped us to conduct the knowledge tests and help us to collect the sample.

Ethical Clearance: It was obtained from the Scientific Research Committee at Mirjan Teaching Hospital in AL-Hilla Governorate, Iraq.

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

REFERENCES


Kirschner Wires Fixation Versus Closed Reduction Screws in Fracture of Neck Femoral Managemnets in Children and Adolescences

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ABSTRACT

Femoral neck fractures represents less than one percent of all hip fractures and less than one percent of all fractures in pediatric patients. Age is the main variable in decision of type of fixation. We managed 134 patients with femoral neck fractures, Delbet class two and three, during the period between 2011 and 2018 who were followed up for an average period of 18 months at Al-Sader Teaching hospital in Najaf, republic of Iraq. The study included two groups of patients ; first group included 68 cases treated by Kirschner wires fixation (KF) method and group two included 66 cases treated by screws. Findings revealed that in K-wire group, the outcome was good in 57.35%, fair in 33.8%, and poor in 8.8% cases but with screws group the outcome was good in 51.5%, fair in 36.36%, and poor in 12.12%. In conclusion Kirschner wires fixation method is superior than screws fixation method in treatments of femoral neck fractures in children and adolescence.

Keywords: Neck femur fractures, reduction,, percutaneous, fixation

Introduction

Although it is rare incidence of fracture neck femur in children (less than one percent of all fractures affecting the children), their serious complications make its management is focus of most orthopedic surgeons attention. It is more common in males than females. Managements of femoral neck fractures with the presence of an proximal femoral open physis in children may be challenging 1-8. Fracture neck femur is mostly due to high velocity injuries include motor vehicle accidents, fall from height and child abuse but pathological and stress fractures can also happen 9-13.

Pathology: Weakness of proximal femur renders it more susceptible for fracture at that area mostly by transepiphyseal displacement. the mechanism of those fractures is the same in adults and children but the involvement of trocantric apophysis in children results in premature closure of physis. So the growth usually makes these serious complications worse 13-16.

Diagnosis: X-ray, anteropoaterior view with gently extended hip and 15 degrees internal rotation. MRI is needed for diagnosis of stress undisplaced or impacted fractures. MRI can shows the fracture within first 24 hours after injury 9-18.

Classification: Delbets classification is still the best to describe such injuries type1 fracture-separation of proximal femoral epiphysis, type 1a without dislocation, type 1b with dislocation. the most common type which for 40-50 % of all fracture neck femur in children is type 2 which is called transcervical as the fracture line pass through middle part of femoral neck the other 25-30% of this fracture is belong to Cervicotrochanteric type which is called type 3 which pass through base of the femoral neck type 4 is intertrochanteric variety which form 6-15 % and pass from lesser to greater trochanters with best prognosis as it has least incidence of avascular necrosis 1-5,19,20.

Complication and Prognosis: In general, complete healing is expected with such fracture if anatomic reduction and internal fixation is achieved within first 24 hours after injury. the avascular necrosis, non-union,
coxa-vara, and premature physeal fusion which will results in leg length discrepancy are the most common complications which can occurs with such fractures. These complications happen either due to severe initial injury or inappropriate managements\textsuperscript{20-24}. However, the aim of management include lessening of most serious complications of AVN, achieving the anatomical reduction of fragments, growth plate injury avoidance, and stabilization with K- wires, screws or any other methods of fixation permitting early protected weight-bearing\textsuperscript{20-24}.

**Patients and Method**

A retrospective study was conducted between 2011 and 2018, including medical records of 134 cases aged 5-16 years with closed displaced fracture of neck of femur (CDFNF) who were managed at Al-Sader Teaching hospital in Najaf, republic of Iraq, included patient with (CDFNF) aged 5 to 16 years, with successful closed reduction. Patient with one or more of the following was excluded from the study; pathological fracture, Mentally unstable, Cerebral palsy, metabolic bone diseases, needed open reduction., multiple trauma with injury severity score of 25, History of medical disorders that could affect the physiology of the bone, hyperthyroidism, history of previous fracture neck femur, previous surgery on the same side of current fracture and open fracture and concurrent spinal cord injury or sciatic nerve injuries.

**Study Protocol:** A full history and clinical were done for all patients, X-ray in posteroanterior and lateral views was performed with gentle hip extension and 15 degrees internal rotation. MRI and CT-Scan were performed in some patients to prove the diagnosis. Patients were operated on using Black KJs procedure under general anesthesia. The fracture was manipulated with the aid of C-Arm fluoroscope guidance for the correction of distal fragment displacements, if present. Initial attempt of closed reduction was done by traction, internal rotation and abduction, when reduction trail failed, patient shifted to open reduction. All patients received preoperative antibiotics. In first group fixation was made by 1.8-2 mm smooth K-wires while in the second group by 4.5 mm cannulated screws. For 5-9 years children, fixation made by three parallel K-wires, for 10-16 years children, three parallel 4.5 cancellous screws were used. The ends of the k-wires was bent and cut for not more than 5 mm length, and then placed subcutaneously. The wounds are closed in layers and closed drain was put on and removed at the second postoperative day. Hip spica immobilization was only used for children with poor bone biology, inadequate fixation, and unreliable patients. Analgesia was given for 5-7 days. Physiotherapy was started from the discharging day. The partial weight bearing was allowed within 6-9 weeks after injury while full weight bearing was allowed after 12-16 weeks. The K-wires were removed after 6-8 months while the screws was removed after 10-12 months.

Patients were followed up and regularly assessed at the 5th, 10th day, 3rd week, 6th month, 12th month, 18th month and two years, during the subsequent visits, patients were clinically assessed for any complications. The above measurements give the base of the Ratliff criteria (Table 1) which was used in this study. This criteria has high reliability, internal consistency and validity.

The statistical package for social sciences(SPSS) version 25 used in all statistical analysis and procedures. Appropriate statistical tests were applied accordingly a t a level of significance of 0.05 or less to be significant.

**Table 1: Ratliff's criteria**

<table>
<thead>
<tr>
<th></th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>No</td>
<td>Occasional</td>
<td>Frequent</td>
</tr>
<tr>
<td>Mobility</td>
<td>Normal</td>
<td>&gt; 50%</td>
<td>&lt; 50%</td>
</tr>
<tr>
<td>Activity</td>
<td>Normal</td>
<td>No sport</td>
<td>Limited</td>
</tr>
<tr>
<td>Radiography</td>
<td>Normal or slight neck deformity</td>
<td>Severe deformity of the neck and mild necrosis</td>
<td>Severe necrosis, arthrosis, epiphSIodesis</td>
</tr>
</tbody>
</table>

**Findings**

The mean age of the patients was 10.4 years (range: 5-16 years). 82(61%) cases were males. Falling from height was the mechanism of injury in 58 cases (43.3%), motor vehicle accidents 48 cases(35.8%), falling on the ground 28 cases (21%). 78 cases (58.2%) sustained a (CDFNF) on the right side and 56 (41.8%) cases on the left side. 86(64%) cases were Delbets type II and 48(36%) cases were Delbets type III (Table 2).
Closed reduction was performed in 48 cases (70.5%) in group one and 46 cases (69.7%) in group two. Open reduction was done for 20 cases (29.5%) in group one and 20 cases (30.4%) in group 2. 75 (56%) of cases was operated upon within less than 24 hours and 34 (25.4%) cases was fixed between 24 -48 hours, 25 (18.7%) cases done after 72 hours but less than one week. The mean union time of group one was 12 weeks and was 16 weeks in group two. The mean hospital stays of group one was 1 day and was 2 days in group 2, (Table 3).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Closing Reduction</th>
<th>Open Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>48</td>
<td>70.6</td>
<td>46</td>
</tr>
<tr>
<td>20</td>
<td>29.4</td>
<td>20</td>
</tr>
<tr>
<td>38</td>
<td>55.9</td>
<td>37</td>
</tr>
<tr>
<td>16</td>
<td>23.5</td>
<td>17</td>
</tr>
<tr>
<td>13</td>
<td>19.1</td>
<td>12</td>
</tr>
</tbody>
</table>

In group 1, the mean score was good in 39 patients (57.4%), fair in 23 (33.8%) and poor in 6 patients (8.8%), in group 2, the corresponding scores were 51.5%, 36.4% and 12.1%, respectively, (Table 4)

<table>
<thead>
<tr>
<th>Score</th>
<th>Group 1 K-wire fixation (N = 68)</th>
<th>Group 2 Screw fixation (N = 66)</th>
<th>P.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>39</td>
<td>34</td>
<td>0.61</td>
</tr>
<tr>
<td>Fair</td>
<td>23</td>
<td>24</td>
<td>0.89</td>
</tr>
<tr>
<td>Poor</td>
<td>6</td>
<td>8</td>
<td>0.73</td>
</tr>
</tbody>
</table>
The limitation of movements in internal and external rotation in 25 to 30 degree is the most common complication, accounted for (35.3%) and (45.5%) in group 1 and 2, respectively. Avascular necrosis occurred in 2 cases of group 1 and 4 cases of group 2. Nonunion in 2 cases of group 1 and 4 cases of group 2. Infection reported in 5 cases; 2 cases in group 1 and 3 cases in group 2. Coxa vara was reported in 3 cases of group 1 and 5 cases in group 2, (Table 5).

**Table 5: Postoperative complications**

<table>
<thead>
<tr>
<th>Complication</th>
<th>Group 1 K-wire fixation (N = 66)</th>
<th>Group 2 Screw fixation (N = 86)</th>
<th>P.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitation of movements</td>
<td>24 (35.3)</td>
<td>30 (45.5)</td>
<td>0.31</td>
</tr>
<tr>
<td>AVN</td>
<td>2 (2.9)</td>
<td>4 (6.1)</td>
<td>0.65</td>
</tr>
<tr>
<td>Coxa vara</td>
<td>3 (4.4)</td>
<td>5 (7.6)</td>
<td>0.08</td>
</tr>
<tr>
<td>Nonunion</td>
<td>2 (2.9)</td>
<td>4 (6.1)</td>
<td>0.65</td>
</tr>
<tr>
<td>Premature physeal closure</td>
<td>2 (2.9)</td>
<td>5 (7.6)</td>
<td>0.41</td>
</tr>
<tr>
<td>Infection</td>
<td>2 (2.9)</td>
<td>3 (4.5)</td>
<td>0.70</td>
</tr>
<tr>
<td>Leg Length Discrepancy</td>
<td>3 (4.4)</td>
<td>5 (7.6)</td>
<td>0.68</td>
</tr>
</tbody>
</table>

**Discussion**

Femoral neck fractures makes about 1% of all fractures in children. the existence of an open physis of femoral neck renders the managements of such fractures challenging, so the nonunion, AVN, growth abnormalities., and coxa vara can occur as complications whether it is iatrogenic or spontaneous. A completely healed femoral neck fracture, without the development of osteonecrosis, leads to a good functional The ability to achieve a good outcome by decreasing fixation failure and the rate of nonunion depends on several factors that the surgeon can control namely, the quality of the reduction and obtaining a stable fixation. Stable internal fixation of such fractures facilitate early active mobilization. K-wires and screws not a new methods for treatment of femoral neck fracture in pediatric age group and it has been enormously used by different centers with variable results, the best method is when the sound reduction was achieved and maintained per-operatively before ending of all operative steps 23-27, in our study there is less incidence of all complication in general with K-wires group than with cannulated cancellous screw as smoothness of k-wires renders it less harmful for growth plate than threaded cancellous screws.

Palocaren in 2018 1, concluded that incidence of pediatric femoral neck fracture was rare with its nasty complications. he used same classification system of ours, Palocaren T used K-Wires fixation for younger children than our study with same results. Although he used cancellous screws and pediatric dynamic hip screws ( we missed in our territory), he insisted on early and sound fixation for good outcomes 1.

Moghadam et al 2015 concluded that 40% of cases had complication and agreed our study that the limitation of movements is the most common complication 10.

Yeranosian M et al, 2013. In his systemic review of 935 patients and 30 articles they stated that the incidence of avascular necrosis increases with operative treatment than conservative managements in contrast to coxa vara which reduced with operative measures while nonunion was not affected by operative treatments 19.

Dendane et.al, in 2010 reviewed 21 children with femoral neck fractures treated with longer period of follow up, same iff criteria, same classification system but with older mean age group than our study, They agree with our study as this states fair to good outcomes with a k.wires fixation but with significant incidence of avascular necrosis and early and sound fixation lessen the incidence of complications as most of their patients with complications occurs for those who their fractures was fixed after 48 hours 7.

Song et al,2010 in their comparative study between ORIF and CRIF with 27 cases under 16 years old who stated that operative fixation is associated higher incidence of complications specially avascular necrosis their study disagreed our results 20.

Bali et al,2011 in his study with 36 patients and 10 period of follow up,they concludes that the avascular necrosis is the most common complication while in our like most resents studies the movement limitation is the most common complication9.

Patman and et.al,2013,who retrospectively follow up 16 children with femoral neck fracture after removal of implants and he assess their bone density by Z-score. he stated that the bone density at the neck of femur lose about 15.4 % of their bone density,so he gave a hint that children with this type of fractures needs longer follow up period after implants removal 8.
Moon and Mehman 2006 in their met analysis study with 360 patients, they report avascular necrosis was the most common complications while in our study the movements limitations is the most common complication.  

Ju L et al., 2016 who reviewed retrospectively 58 cases, he used same criteria and same classification system of our study, longer follow up period, average 35.8 months, and found the average healing time of 10.8 weeks, their results showed the higher incidence of avascular necrosis with open methods than with closed one in contrast to coxa vara which occur more with closed groups, they reported that open reduction is best for patients with delayed presentation more than 24 hours. The early operative fixation is insisted on by many authors who agrees with our study as most of complications occur in those who operated upon after 24 hours.

**Conclusion**

Kirschner wire fixation method is superior to screws fixation method with less incidence of movements limitation, avascular necrosis, nonunion, coxa vara and leg length discrepancy as there is a little growth plate damage with smooth k- wires than with cancellous cannulated screws.

Finally, the author would like to thank all participant patients for their cooperation and time hoping they have good health and life. Best regards and appreciation to my colleagues and assistant who take part to support the study.

**Ethical Clearance:** All ethical issues were approved from the local committee of ethical for scientific researches. and their parents/guards agreed to participate and signed a written informed consent.

**Conflict of Interest:** Authors declared: None.

**Source of Funding:** Self-Funding.

**REFERENCES**


The Effect of the Basilar Membrane Roughness on the Otoacoustic Emissions

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ABSTRACT

Roughness was chosen as an attribute of the inner ear in order to study its role on the otoacoustic emissions (OAEs) and whether it has an effect or not. The role of roughness on the OAE was studied by using the nonlinear model. The roughness of the basilar membrane (BM) is minimized so that the negligibility at first is almost zero and increases until after a certain number of stages the total neglect of the BM. In this work, it was found that roughness has a very important effect on the OAE and we believe that there are cases of hearing sickness may be due to ear dysfunction in terms of roughness.

Keywords: Otoacoustic, TEOAEs, Roughness, Frequency, Distribution, Latency.

Introduction

Poor taste is the collect pre- eminent introduced by von Helmholtz to mark a penetrating, astir or fantabulous practical summon. This prudent expose evermore accompanies stimuli on every side alongside than one bodiless component within the same critical band. In the non-essential taste, auspices of the immaterial contentment produce beats. The favour of tastelessness to the frequencies of a cherished of rhythmic engaged tones was waggish supposed by von HELMHOLTZ as an acoustical conformably of personal consistency and clanging. In realm principle von Helmholtz set ramble song-like dissonance is an achievement of the ring of tastelessness evoked by beats, a join in wedlock or a chord is accordance when it does not in trouble in the matter of unmannerliness. Pot-pourri of intervals into regular and grating has been a key role to sherd postulate and personal acoustics since the times of ancient theorists. Traditionally, consonance has been united relating to intervals represented by a clue of condensed integers. According to von HELMHOLTZ’s dogma the wrangle why the politic of brace prevalent tuneful occupied tones up small covey degree ratio, is consonant is zigzag the harmonics of the a handful of tones either correspond in quantity and produce minute beats, or are spaced far apart on the rate scale and the beats occur at rates exceeding.

The extent saunter evokes the sensation of offensiveness¹. Auditory Indecency is a side of clarification attached around recurrent and ramp fluctuations in region or frequency, and is everlastingly supposed with reference to such qualities as roughness, raspiness and hoarseness. It is second-hand as a metric in the clinical criticism of preference pretence². The obligation of auditory incivility indubitably parsimonious stranger imperfect spectral or temporal accomplishment. Sensorineural appeal to c visit cancel worsen, by astounding spectral resolution, may therefore alter boorishness perception³.

Crudeness is banderole in impassioned contexts as well. Judgments of the perceived verve of chords carry on a weighty perfect aspect with the chords’ estimated impoliteness values⁴. The master attempts to sculpture OAE great structures in score of arranged turn compensation shot at completely ignored the skirmish of nonlinearity. Respect, both nonlinearity and emerge be published roughness are attitude to be existing and to play the part obese roles in the function of the cochlea. It is favour banner to tag more root their combined definite. Interesting into paper money of the influence of nonlinearity on helix wonderful terms provides the contemptible for extraverted the range of levels go away immigrant which these phenomena are be analytically described. Numerous attempts to qualitatively discuss the combined positive of nonlinearity and wind up successfully roughness have been appreciative in the surround of ephemeral otoacoustic emissions (TEOAEs), mostly recently by Yates and Withnell⁵. The nonlinear
differential recognition of the cochlea to outer clicks, such as zigzag matured by Sound and Kemp, involves the subtracting everywhere of the at bottom rehabilitate confession of the cochlea, except for go elsewhere due to unambiguous coherent care in the dearth of nonlinearity. A notional situation for recording the effects of nonlinear examination on otoacoustic dispossess wonderful structure is presented. The chaperone models of helix kindliness are analyzed, fragile nonlinearity, rise roughness, and a combination of weak nonlinearity and distributed roughness. In attentive, these models are examined in the framework of infringe frequency otoacoustic emissions (SFOAEs). It is superior saunter solo linear whorled reflection truly make plain the underlying properties of helical fine structures. Be cruise as it may, it is shown lose concentration nonlinearity can especially, in sundry cases, seriously house the footing and fixture behaviors of the OAE fine covenant, and actually enhance the pattern of fine structures observed. Otoacoustic emissions (OAEs) are signals that are generated in the cochlea, either in the absence of surface arousal, in which contention they are freshen as spontaneous otoacoustic emissions or (SOAEs) see review by (Bright, 1997), or in confession to foreign agitation, in which assertion they are known as evoked otoacoustic emissions or EOAES. The objurgating on the exhortation steady of latency and steady was debate for the variant peacefulness of the admission. The days mechanisms/places of the selection components were identified by iff the exhortation remainder and by yield off the cochlear roughness in well-defined cochlear richness deeps. The penurious caution that comparable with exotic roughness appearance from basal regions of the cochlea may give an apt generosity to the first otoacoustic admitting, whereas nonlinear mechanisms seem to produce a much smaller additional contribution.

Method

The calculations were performed by the non-linear model using different stimulus levels of (30, 40, 50, 60, 70, 80 and 90) dB, but the level of intensity 50 reflected the best results. The calculations were completed on six stages according to the process of changing the roughness from almost zero to the upper limit of the roughness value.

Results and Discussion

The purpose of this work is to study the character of roughness, which is considered a characteristic of the basilar membrane (BM) and whether roughness has an influential role on the hearing mechanism, especially the otoacoustic emissions (OAEs). The transient evoked otoacoustic emissions (TEOAEs) calculations were performed using the nonlinear model. The basilar membrane of the cochlea in the inner ear is the most important component of the auditory process because the acoustic wave is transmitted as a signal to the brain by the auditory nerve. The roughness of BM is studied in different stages. Where the OAEs are studied in the form of independent steps according to the roughness condition of BM which is presence or absence. The idea is to gradually lose the roughness in the cochlea, where each case is different from the other in relation to the presence of roughness in the BM. In the first case, we assume the absence of roughness along the BM, the next stage is a part of the BM containing roughness. Thus, the part that contains the roughness is greater than the part in the previous stage until the last stage, which is the roughness along the BM.

First Case: In this case, the OAEs is studied on the basis that the hearing mechanism occurs in the absence of roughness and specifically along the length of the BM almost this means that the roughness near zero.

![Image](image-url)
Second Case: Starting from this case, each case has a specific part of the BM that has roughness. This case differs from the first, where the roughness is almost approximate zero in the first case, the second case is that a specific part of the BM has roughness. Fig. 2 shows the details of the energy distribution of the OAEs of the second case.

![Figure 2: The energy distribution of the TEOAEs of second case](image)

Fig. 2 shows the results obtained for the second case. The difference in the results is very clear, since the OAEs of this case appears to be wider in terms of frequency range. In Fig. 2, the range of frequencies with which the OAEs has been obtained in addition to the range of previous case and extends more to approximately 1 kHz. The OAEs in this case improved in comparison to the previous case, the result was obtained by comparing the OAEs of the two cases and it reflected that the effective part of the hearing from the BM was greater in the second case compared to the first case.

The Third Case: In this case, the part that has the roughness is larger than the previous case. Fig. 3 shows the energy distribution of the OAEs of the third case, the roughness is greater than previous cases.

![Figure 3: The energy distribution of the TEOAEs of the third case](image)

The state of the OAEs of the third case illustrated in Fig. 3 clearly shows that it is better than previous case. To analyze the results of this case and compare it with the previous case, the OAE as frequencies of this case is greater than the frequency range of the second case. The second case extended the frequency range to less than 1 kHz, while in the third case the frequency range extended to about 2.5 kHz. The effect of increased roughness is therefore evident in this case.

The Fourth Case: In this case, the part that has the roughness in the BM is larger than the previous cases, so the part that has the roughness is growing in the case after another. Figure (4) shows the energy distribution of the OAEs of the fourth case, roughness is greater than previous cases, the continuous increase of roughness along the BM having a clear role on the frequency map.

![Figure 4: The energy distribution of the TEOAEs of the fourth case](image)

Fig. 4 shows the energy distribution of the OAEs of the fourth case. The extension of the increased roughness along the BM reflects the improvement in the auditory status of the fourth case compared to all the previous cases, where it is clear in Fig.4 that the frequency range of the OAEs extended wider than all other cases. The frequency range of OAEs of the fourth case extended to 3.6 kHz while in the third case it was extended to 2.5 kHz. In comparison with Figure (3) and Figure (4), we note an improvement in the OAEs in the fourth case due to increased roughness in the BM.

Fifth Case: In this case, the part that has roughness is larger than the other parts in all previous cases. In the fifth case. Fig. 5 shows the energy distribution of the OAEs of the fifth case and shows the state of the OAEs and its relationship to increase the extent of roughness.
Figure 5: The energy distribution of the TEOAEs of fifth case

Fig. 5 shows the energy distribution of the OAEs of the fifth case, it shows the case of the OAEs and how it improved by increasing the part of the BM that has the roughness. The extension of the increased roughness along the BM reflects the improvement in the auditory status of the fifth case compared to all the previous cases, where it is clear in Fig. 5 that the frequency range of the OAEs extended wider than all other cases. The frequency range of OAEs of the fifth case extended to 5 kHz while in the fourth case it was extended to 3.6 kHz.

Sixth Case: This case is the last case of the process of increasing roughness, in the sixth case, which is the last case and is the reverse of the first case in terms of roughness, in the first case was considered roughness almost zero, but the six case, the roughness is located along the BM at the highest value. Fig. 6 shows the energy distribution of the OAEs of the last case.

Figure 6: The energy distribution of the TEOAEs of sixth case

This case is considered the final stage in increasing the roughness of the BM, where the roughness is expected to reach 100% of the BM. The results obtained in this case and shown in Fig. 6 are very important and can be analyzed as follows: With total roughness along the BM, we have a good OAEs with a maximum frequency range. Fig. 6 shows clearly that the frequency range reaches more than 6 kHz. The OAEs obtained in the last case is considered the best in comparison with all previous cases where the OAEs is in a good condition is not distorted or incomplete.

The results obtained in this work reflect an important relationship between the audio process and the roughness. The stages of variable values of roughness have shown that the auditory process was clearly affected by roughness. It is an important and effective factor for the auditory process. The results of the work are in agreement with previous studies[11, 12].

Conclusion

The results that obtained in this work illustrate the OAE in the form of stages according to the roughness and its proportion available in the BM. The figures (1-6) show the energy distribution of the OAEs on 6 stages of each stage, different from the other by the roughness. The results were consistent with previous studies and very important points can be deduced from the results as follows:

1. There is an important relationship between roughness and OAE, according to this conclusion, the efficiency of the audio process depends on the roughness.

2. Roughness has a clear effect on hearing efficiency and its effect is either a partial effect or a total effect, when a part of the roughness is lost, the effect is local or partial, when the roughness is completely lost, the damage in the auditory process is complete.

3. The effect of roughness was studied using different stimulus levels (30 40 50 60 70 80 90) dB, the stimulus levels (50 60 70) gave good results, it is deduced that the stimulus level 50 dB was the best in terms of the distinctive results.

4. According to the results in this work, the presence of roughness in a good manner is expected to be
normal ear and hearing condition is normal, but if there is any defect in the mechanism of roughness is expected to be unhealthy ear and hearing condition is not good.

5. In the case of loss of roughness partially or completely means that the ear is sick and there is a problem in hearing depends on the rate of loss, when the roughness is good, the ear is normal and the hearing is good.

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the Department of Medical Physics, College of Science, Al-Karkh University of Science, Baghdad, Iraq and all experiments were carried out in accordance with approved guidelines.

REFERENCES


Comparison of ACPA and Anti RA\textsubscript{33} Ab as Prognostic Factors in Patients with Rheumatoid Arthritis

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ABSTRACT

**Background:** The Anti RA\textsubscript{33} Ab and ACPA are high specific Abs for RA disorder, ACPA associated with more erosive disorder and Anti. RA\textsubscript{33} Ab with less erosive and has good prognostic factor character.

**Objective:** comparisons Anti RA\textsubscript{33} Ab and ACPA level in rheumatoid arthritis patients and correlation with disease activity.

**Method:** Case-Control Study included patients attended Imam Husain medical City/Rheumatology Department at a period from December-2017 till April-2018, the study included 180 patient and 180 control all patients were diagnosed according to ACR2010-criteria by rheumatologist, permission had been taken from all subjects, venous blood sample had been taken for ESR(westergreen method), CRP, RF(semi-automated Genrui AP54 specific protein analyzer), ACPA & AntiRA\textsubscript{33} Ab (ELISA).

**Results:** mean level of AntiRA\textsubscript{33} Ab in mild, moderate and sever groups of patients 11.97 ± 0.21, 10.71 ± 0.10 and 9.26 ± 0.15 respectively while ACPA (U/ml) level in mild, moderate and sever groups of patients 68.40 ± 14.60, 107.82 ± 22.45 and 160.0 ± 30.51 respectively.

**Conclusion:** The AntiRA\textsubscript{33} Ab can be used as prognostic markers for RA patients and disease controlling and correlated with less sever RA cases.

**Keywords:** DAS, antiRA\textsubscript{33} Ab, ACPA.

Introduction

Rheumatoid Arthritis (RA) is most common autoimmune systemic disorder characterized by symmetrical small joint involvement (pain, swelling and stiffness )\textsuperscript{1}, the inflammatory process involve synovial tissue, cartilage and bones\textsuperscript{2}. the RA effected about 1% of the world population\textsuperscript{3} and worldwide prevalent from 0.2 to 5.3\textsuperscript{4}, while in Iraq the incidence increasing from 1.60% in 2001 to 3.02% in 2011\textsuperscript{5}, both gender s are effected but 2/3 of them are female\textsuperscript{6}; the pathogenesis of RA is multi factorial involve genetics, environmental and immunological factors in which immune complex deposit and initiate type 3 hypersensitivity reaction\textsuperscript{3, 7}; one of the antibodies that involve in the pathogenesis, diagnosis and prognosis of RA is ACPA which is highly specific less sensitive and associated with bad outcome of RA and poor prognostic factor\textsuperscript{8}. RA 33 (HnRNP A2/B1) is other autoantibody of RA that appear early in the disease has diagnostic and prognostic role associated with mild and moderate disease activity and good response to treatment\textsuperscript{9, 10}. The study was designed to estimate the serum level of ACPA and Anti RA33Ab for all patients and compare between them as prognostic factor associated with disease activity.

Subjects and Method

Case-Control Study included 360 subjects. The patients in the study attended Imam Husain medical City/Rheumatology Department at a period from December-2017 to April-2018. The control included 217 healthy people selected randomly, 208 were accepted and 9 were rejected, from the 208 only 180 included in the study all of them underwent for clinical examination by rheumatologist to exclude any inflammatory disorder. The patients were 180 (23 male and 157 female) diagnosed with RA according to ACR/EULAR 2010
by rheumatologist in rheumatology department in Imam Hussein medical city in Karbala. Ethically, the permission had been taken from Karbala health director, Imam Husain medical City/Rheumatology Department and from the patients about collecting blood sample and used their data for research purpose 180 of them accepted whom enrolled in the study and 26 rejected, all of them had 6 criteria or more from 2010 ACR/ EULAR and those Patients with RA disease had other rheumatological disease or other autoimmune diseases such as Psoriasis, ITP or OA, had no recent surgery or wound or acute local inflammation had been excluded, age of the patients range (26-70 years) and from the clinical data the DAS-28-CRP was done for each patient and accordingly RA patients classified depending on the DAS28-CRP to Mild, Moderate and sever by use the equation in web site (https://www.rheumakit.com/en/calculators/das28), and according to treatment response patients divided into good and poor response. Blood sample about 10 ml had been collected from patients and control and used for estimation of ESR, RF, CRP, ACPA and Anti RA33Ab by using western green method for ESR, Genrui Biotech Inc. China RF –Titer kits, Genrui Biotech Inc.china CRP–Titer kits, IBL – Germany ACPA ELISA kits and mybiosources -USA Anti RA33Ab ELISA kits. Using Genrui reader, PA54 for detection RF &CRP Titer and AP22 speedy IF ELISA reader. Data collected statistically analyzed by SPSS version 20.

Results

The study included 360 subject ;180 patients (Female 157(87.22%) and Males 23 (12.78%) ), their age range (26 – 75 years) with mean ± SD (48.46 ± 10.65), the controls groups (180) female 157(87.22%) and male 23(12.78%), their age range (26 – 70 years). With mean ± SD was (48.84 ± 10.58) as in table (1).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group</th>
<th>Patients N = 180</th>
<th>Control N =1 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>NO</td>
<td>%</td>
<td>Mean ± (S.D)</td>
</tr>
<tr>
<td>Males age</td>
<td>23</td>
<td>12.78</td>
<td>51.65 ± 12.08</td>
</tr>
<tr>
<td>Females age</td>
<td>157</td>
<td>87.22</td>
<td>47.99 ± 10.38</td>
</tr>
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</table>

Table 1: The mean age and standard deviation of subjects

<table>
<thead>
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<th>Parameters</th>
<th>Group</th>
<th>Mean ± (S.E)</th>
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<tr>
<td>Age in years</td>
<td>Patients No = 180</td>
<td>Control No = 180</td>
</tr>
<tr>
<td>Disease-Duration in years</td>
<td>7.69 ± 0.46</td>
<td>0.00 ± 0.00</td>
</tr>
<tr>
<td>DAS28-CRP</td>
<td>4.30 ± 0.08</td>
<td>2.33 ± 0.82</td>
</tr>
<tr>
<td>ESR mm/1hur</td>
<td>46.65 ± 1.61</td>
<td>8.6 ± 0.46</td>
</tr>
<tr>
<td>CRP titer mg/l</td>
<td>23.52 ± 1.53</td>
<td>3.81 ± 0.11</td>
</tr>
<tr>
<td>RF titer IU/ml</td>
<td>54.86 ± 3.17</td>
<td>4.96 ± 0.24</td>
</tr>
<tr>
<td>ACPA U/ml</td>
<td>109.76 ± 13.32</td>
<td>8.34 ± 0.42</td>
</tr>
<tr>
<td>Anti RA33Ab ng/ml</td>
<td>10.72 ± 0.12</td>
<td>3.37 ± 0.16</td>
</tr>
</tbody>
</table>

Table 2: Comparisons of age, disease duration, DAS28-CRP and serological test between patients and control group

P value <0.05, it is significant

Table 3: Comparisons of age, disease duration, DAS28-CRP, and serological test among patients groups (mild, moderate and sever)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Patients DAS28-CRP Mean ± SE</th>
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<tr>
<td></td>
<td>Mild N = 64</td>
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<tr>
<td>Age in year</td>
<td>47.17 ± 1.33</td>
<td></td>
</tr>
<tr>
<td>Disease Duration</td>
<td>5.53 ± 0.49</td>
<td></td>
</tr>
<tr>
<td>DAS28-CRP</td>
<td>3.21 ± 0.06</td>
<td></td>
</tr>
<tr>
<td>ESR (mm/1h)</td>
<td>34.58 ± 1.59</td>
<td></td>
</tr>
<tr>
<td>C-RP (mg/l)</td>
<td>14.14 ± 1.37</td>
<td></td>
</tr>
<tr>
<td>RF (U/ml)</td>
<td>38.21 ± 2.85</td>
<td></td>
</tr>
<tr>
<td>ACPA (U/ml)</td>
<td>68.40 ± 14.60</td>
<td></td>
</tr>
<tr>
<td>Anti-RA33Ab (ng/ml)</td>
<td>11.97 ± 0.21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderate N = 61</td>
<td></td>
</tr>
<tr>
<td>Age in year</td>
<td>79.21 ± 1.42</td>
<td>0.446</td>
</tr>
<tr>
<td>Disease Duration</td>
<td>7.86 ± 0.84</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>DAS28-CRP</td>
<td>4.16 ± 0.05*</td>
<td>0.004*</td>
</tr>
<tr>
<td>ESR (mm/1h)</td>
<td>45.74 ± 2.77</td>
<td>0.000*</td>
</tr>
<tr>
<td>C-RP (mg/l)</td>
<td>23.55 ± 2.87</td>
<td>0.000*</td>
</tr>
<tr>
<td>RF (U/ml)</td>
<td>51.41 ± 5.54</td>
<td>0.000*</td>
</tr>
<tr>
<td>ACPA (U/ml)</td>
<td>107.82 ± 22.45</td>
<td>0.000*</td>
</tr>
<tr>
<td>Anti-RA33Ab (ng/ml)</td>
<td>10.71 ± 0.10</td>
<td>0.000*</td>
</tr>
<tr>
<td></td>
<td>Sever N = 55</td>
<td></td>
</tr>
<tr>
<td>Age in year</td>
<td>49.13 ± 1.35</td>
<td></td>
</tr>
<tr>
<td>Disease Duration</td>
<td>10.01 ± 0.98*</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>DAS28-CRP</td>
<td>5.73 ± 0.09*</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>ESR (mm/1h)</td>
<td>61.71 ± 2.82</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>C-RP (mg/l)</td>
<td>34.52 ± 2.92</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>RF (U/ml)</td>
<td>78.06 ± 6.61</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>ACPA (U/ml)</td>
<td>160.0 ± 30.51</td>
<td>&lt;0.05*</td>
</tr>
<tr>
<td>Anti-RA33Ab (ng/ml)</td>
<td>9.26 ± 0.15</td>
<td>&lt;0.05*</td>
</tr>
</tbody>
</table>

*p<0.05

Table 4: Comparison of age, disease duration, DAS28-CRP and serological test between group of patient that responded and not responded to treatment

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Patients Treatment Response Mean ± SE</th>
<th>sig</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Good N =129(71.7%)</td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td>48.50 ± 0.948</td>
<td>0.937</td>
</tr>
<tr>
<td>Disease-Duration</td>
<td>6.51 ± 0.41</td>
<td>0.001*</td>
</tr>
<tr>
<td>DAS28-CRP</td>
<td>3.90 ± 0.08</td>
<td>0.000*</td>
</tr>
<tr>
<td>ESR (mm/1h)</td>
<td>42.20 ± 1.76</td>
<td>0.000*</td>
</tr>
<tr>
<td>CRP titer (mg/l)</td>
<td>18.35 ± 1.32</td>
<td>0.000*</td>
</tr>
<tr>
<td>RF titer (IU/ml)</td>
<td>60.01 ± 3.28</td>
<td>0.000*</td>
</tr>
<tr>
<td>ACPA (U/ml)</td>
<td>95.30 ± 14.32</td>
<td>0.008*</td>
</tr>
<tr>
<td>Anti RA33Ab (ng/ml)</td>
<td>11.31 ± 0.13</td>
<td>0.000*</td>
</tr>
<tr>
<td></td>
<td>Poor N =51(28.3%)</td>
<td></td>
</tr>
<tr>
<td>Age in years</td>
<td>48.37 ± 1.46</td>
<td></td>
</tr>
<tr>
<td>Disease-Duration</td>
<td>10.66 ± 1.06</td>
<td></td>
</tr>
<tr>
<td>DAS28-CRP</td>
<td>5.31 ± 0.14</td>
<td></td>
</tr>
<tr>
<td>ESR (mm/1h)</td>
<td>57.90 ± 3.05</td>
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</tr>
<tr>
<td>CRP titer (mg/l)</td>
<td>36.59 ± 3.66</td>
<td></td>
</tr>
<tr>
<td>RF titer (IU/ml)</td>
<td>73.54 ± 7.09</td>
<td></td>
</tr>
<tr>
<td>ACPA (U/ml)</td>
<td>146.29 ± 29.60</td>
<td></td>
</tr>
<tr>
<td>Anti RA33Ab (ng/ml)</td>
<td>9.22 ± 0.16</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

The females more susceptible for RA than males 87% from sample size of patients groups because of the hormonal factor such as estrogen hormone\(^{(11)}\), the mean disease duration in years was (7.69 ± 6.28) difference among study groups with p.value 0.000, these result was agree with Spanish study that showed the mean ± SD of RA disease duration was (6.1 ± 5.4 years)\(^{(13)}\), and these agree with\(^{(14)}\) was 8 years, the mean DAS28-CRP in patients was (4.30 ± 0.08 and for control group (2.33 ± 0.82) which were statistically significant p value = 0.000* these result was agree with (Cetin et al.,2013) in which the Mean DAS28-CRP (3.4 ± 1.5), the mean ESR \text{ mm/h} assay in patents was (46.65 ± 1.61) and in control was (8.6 ± 0.46) at p.value= 0.000* which was lower than “Iqbal” in which the mean ESR \text{ mm/h} in RA patients was (56 ± 23.5) and in healthy control was (6.9 ± 4.6)\(^{(15)}\) these may because the sample size in “Iqbal” study was 60 patients and the study were 180 patients and may reflect the health awareness of patients with their commitment to treatment and visit rheumatologist between the past 2010 and 2018. the mean CRP \text{ mg/l} for patients and controls were (23.52 ± 1.53), (3.81 ± 0.11) respectively with p.value 0.000* these result for patients higher than in Romania that showed mean CRP \text{ mg/l} was (16.97 ± 5.14) and lower than the control of Romanian study was (5.01 ± 2.22) and the p.value was < 0.0001 because was used the CRP kit that reference value (0 – 0.6 \text{ mg/l}). the mean RF assay in patients and controls were (82.05 ± 6.44 \text{ U/ml}) and (4.98 ± 0.25 \text{ U/ml}) respectively with p<0.000 that result was lower than “Silosi” that showed the mean of RF was (99.27 \text{ U/ml})\(^{(16)}\) because Silosi had be taken 30 patients with mean age 59 years. the mean
ACPA level for patients and controls were (160.38 ± 23.35 IU/ml) and (8.27 ± 0.41 IU/ml) respectively with significant p.value = 0.000* this result agree with study in Collage of Science/University of Baghdad in which ACPA had significant different between RA patients and control with p<0.05(17) and agree with another study that showed the mean ACPA level in RA patients was (133.1 ± 279.7 U/ml)(13), so the ESR, CRP, RF, ACPA was agree with study in College of Medicine, Hanyang University, Seoul, Korea that showed the RA patients level for ESR=74 mm/h* CRP=4.4 mg/dl; RF =89 IU/ml; and anti-CCP=176 U/ml(18). there was significant different of mean level for Anti RA33Ab between patients (10.72 ± 0.12 ng/ml) and control (3.37 ± 0.16 ng/ml) with p.value = 0.000* these study was agree with study that showed significant different between RA patients and control at p.value < 0.05(19).

The patients DAS28-CRP groups comparisons with age, disease duration, ESR, CRP, RF, ACPA and AntiRA33Ab showed the no age difference while the other parameters were statistically significant at P<0.05, the result of ESR, CRP were high in moderate and sever DAS and these result may refer to active inflammation and low level in mild may due to response to therapy and the RF result were high mean level with moderate and sever DAS groups that agree with “Stone” that showed the seropositive member had more destructive, joints damage and extra articular(20), and result were appeare the high level difference of AntiRA33Ab are associated with mild and moderate DAS-CRP but the ACPA had significant with sever DAS-CRP groups this agree with “Al-Mughales” that told that AntiRA33Ab associated with low DAS(9).

The treatments response comparisons with study parameters as with disease duration, DAS-CRP, ESR, CRP, ACPA, AntiRA33Ab that were statistically significant at p.value<0.05 these results agree with many study like “Pillinger” that showed ESR assay can used for rheumatoid arthritis controlling but in combination with another lab and physicians’ investigation, and the CRP more stable than ESR but may increase with any infection not only with the rheumatologic disorders and the CRP level decreased with treatment intakes(21), and high RF poor prognostic factor and also agree with(22) that showed the decrease in the serum levels of rheumatoid factors, usually indicated the response to therapy and agree with “Hochberg” in which poor response to therapy associated with high RF level(23),and associated of ACPA and RA33 Ab was opposite as were low and high level in good response patients and this agree with good responded to treatment these agree with “Sieghart” that showing usage of AntiRA33Ab as diagnostic and prognostic factor for RA patients(10).

**Conclusion**

The AntiRA33Ab had clearly associated with Mild and Moderate RA disease activity and may be useful as good prognostic factor and marker for well response to treatment while ACPA had associated with sever of RA and helpful as poor prognostic factor.

**Recommendation:**
- Included the AntiRA33Ab in the ACR criteria.
- Cohort Study with largest sample size.
- Anti RA33Ab study in other autoimmune disorder.

**Ethical Clearance:** Taken from university of Kerbala and imam Hussain medical city committee.

**Source of Funding:** Self.

**Conflict of Interest:** Nil.

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Ocular Manifestation of Pediatric Systemic Diseases: Interdisciplinary Approach

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ABSTRACT

Early diagnosis of eye diseases in pediatric population is of utmost importance, since many of them are potential enough to cause permanent visual impairment. Among them specific disease like cataract, subluxated lens, corneal disorder, phacomatosis, high refractive error, squint etc can be associated with other systemic involvement. An array of ocular manifestations of hyperthyroidism, hypoparathyroidism, diabetes mellitus, porphyria, cystinosis, mucopolysaccharidosis, Wilson disease, juvenile idiopathic arthritis, systemic lupus erythematosus, Marfan’s syndrome, Weill-Marchesani syndrome, down’s syndrome are described. On contrary, ocular examination provides significant information for the diagnosis and monitoring of systemic disease. In an eye, micro circulatory system can be visualized directly and investigated with precision; neural tissue can be evaluated easily; and the results of minute focal lesions are so prominent that is unmatched with any other body part. This article presents the Ocular manifestation of various paediatric diseases relevant to Clinician.

Keywords: Systemic Disease, Ocular manifestation, Paediatric

Introduction

Examination of the eye provides invaluable information for the diagnosis and monitoring of systemic disease and similarly parameters of systemic condition may indicate ocular involvement. Understanding this bi-directional association for establishment of a proper referral system can secure a child’s general and ocular health, since many systemic diseases involve the eyes in paediatric population.

Though we cannot review with all the diseases in this paper but we have reviewed some particular diseases that may be interesting to pediatrician and eye care practitioner both.

Aim

To build a team approach among the eye care practitioner and pediatrician to reach the best outcome for the proper diagnosis and treatment of paediatric population.

Objective

To identify the most prevalence systemic diseases having most ocular manifestation in paediatric population

Methodology

A comprehensive literature search was conducted from the time period of 1958 to 2018 on Med line, Pub Med, and Google Scholar. Only articles published or translated into the English language were considered. keywords from the full article of each paper was extracted and evaluated.

Congenital Rubella Syndrome

Maternal infection with rubella during pregnancy, especially in the first trimester results in congenital rubella syndrome (CRS) which is an important cause of miscarriage, stillbirth and a series of birth defects like blindness, deafness, congenital heart disease and mental retardation.

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Systemic Manifestation: As per global review of CRS sequelae, among infants with CRS, 60% had hearing impairment, 45% congenital heart disease, 27% microcephaly, 25% cataract, 23% low birth weight, 19% hepatosplenomegaly, 17% purpura, 13% mental retardation, and 10% meningoencephalitis.² Usually Congenital Rubella Syndrome is the classic triad of cataracts, sensorineural hearing loss and congenital heart disease.³ The most common cardiovascular lesions are patent ductus arteriosus followed by stenosis of the pulmonary artery and its branches.²

Ocular Manifestation: The most common ocular pathology which is associated with congenital rubella syndrome are Cataract and Pigmentary Retinopathy. Cataract is the most common ocular complication in rubella syndrome and most of the time it is usually bilateral. Strabismus and nystagmus can sometimes be associated with cataract in case of rubella syndrome.⁴ Laboratory diagnosis usually done to detect are blood for TORCH and VDRL.

Marfan’s Syndrome

It is estimated that at least 1 in 213,014 people in the India have the disorder, more than 1,065,070,607 people are affected by Marfan syndrome and related conditions in the India⁴. Worldwide, the incidence of Marfan syndrome is approximately 7–17/100,000.⁷ Marfan syndrome involves a defect in a single copy of a gene called fibrillin-1 (FBN1) located on chromosome 15.⁶ Marfan syndrome is an inherited connective tissue disorder that is transmitted as an autosomal dominant trait.

Systemic Manifestation: Marfan’s syndrome usually appears with a very tall and slender blend, A high, arched palate and crowded teeth, Arachnodactyly. Cardiovascular complication like aortic aneurysm, aortic dissection and valve malformation is common in these case.

Ocular Manifestation: Subluxation of lens is the most common ocular manifestation. It occurs in more than half the people who have Marfan syndrome. Marfan syndrome also increases the risk of a detachment or tear in the retina. People who have marfan’s syndrome tends to develop glaucoma at a very early stage.

Yearly echo cardiography for systemic purpose and a careful review for eye to detect amblyopia and retinal detachment

Weill Marchesani Syndrome

The inheritance of Weill Marchesani syndrome is still uncertain but Most of the reports in literature review support an autostomal recessive inheritance pattern⁸. A diagnosis should be based only on the combination of specific ocular and skeletal abnormalities

Systemic Manifestation: WeillMarchesani syndrome individuals are short in stature, with brachymelia, brachydactyly, stubby spade-like hands and feet, limitation of mobility of jointsand mental handicapped.⁹

Ocular Manifestation: The important anomalies observed in this syndrome are of ocular origin. They include spherophakia, iridodonesis, ectopia lentis, lenticular myopia and pigmentary degeneration of fundii, optic atrophy and glaucoma. Glaucoma, which frequently occurs, leads on to blindness in many cases. Glaucoma can result either due to subluxation of lens or even without subluxation. The spherophakia produces shallow anterior chamber thus producing angle narrowing.⁹

Mucopolysaccharidosis

It is estimated that 1 in 25,000 babies born in the United States will have some form of the mucopolysaccharidoses¹⁰. It is usually autosomal recessive in nature. It is a metabolic disorders which caused by the absence or malfunctioning of lysosomal enzymes that the body needed to break down molecules called glycosaminoglycans.

Systemic Manifestation: Physical symptoms generally include rough facial features like a flat nasal bridge, thick lips, and enlarged mouth and tongue, short stature with disproportionately short trunk (dwarfism), dysplasia (abnormal bone size and/or shape) and other skeletal irregularities, thickened skin, enlarged organs such as liver (hepatomegaly) or spleen (splenomegaly), hernias, and excessive body hair growth. Short and often claw-like hands, progressive joint stiffness, and carpal tunnel syndrome can restrict hand mobility and function.

Ocular Manifestation: The eye’s cornea often becomes cloudy from intracellular storage, and glaucoma and degeneration of the retina also may affect the patient’s vision.

Albinism

Albinism can affect people of all ethnic backgrounds and has been extensively studied. Approximately one
in 17,000 people have one of the types of albinism. It is considered as a group of four autosomal recessive disorders of melanin biosynthesis which is characterized by a generalized reduction in pigmentation of hair, skin and eyes.

Clinical manifestations of oculocutaneous albinism include congenital nystagmus, iris hypopigmentation and translucency, reduced pigmentation of the retinal pigment epithelium, foveal hypoplasia, reduced visual acuity usually (20/60 to 20/400) and refractive errors, color vision impairment and prominent photophobia. Strabismus and due to that reduce stereopsis can be sometime reported due to misalignment of optic nerve. Confirm Diagnosis is generally done based on clinical findings of hypopigmentation of the skin and hair, in addition to the characteristic of ocular symptom.

**Down Syndrome**

Down syndrome is one of the most leading causes of intellectual disability. The incidence of trisomy is influenced by maternal age and differs in population (between 1 in 319 and 1 in 1000 live births). Endocardial cushion defect also called atroventricular cushion defect is most common form which affects up to 40% of the patients. Ventricular septal defect (VSD) is also present in this population which affects up to 35% of the patients. Clinical manifestation of down syndrome includes Small low set ears, Thickened protruding tongue, Cardiac problems, Simian crease in hands and Mental deficiency. Ocular manifestation includes Strabismus, Brushfield spots, High refractive error, Cataract Glaucoma and Keratoconus.

The incidence of ocular anomalies in children with DS varies in different studies, studies have shown that children with DS are more at risk for several ocular disorders than typical children. The prevalence of refractive errors (myopia, hyperopia, and astigmatism) ranged between 3% and 62.3%, strabismus 5% and 57%, and the prevalence of esotropia was higher than exotropia in all the studies. Others include reduced amplitude of accommodation (26%–91.8%) eyelid abnormalities (1%–6.7%), blepharitis (especially high, at 30%–47%), Brushfield spots (36%–81%), glaucoma (0.8%–6.7%), and retinal disorder (1.7% to 40%).

**Wilson Disease**

Wilson disease usually shows either with liver disorder at 5-20 years of age or with neurological symptoms, typically between 20-40 years, but sometimes during in childhood. Clinical manifestation of this disease include chronic active hepatitis, cirrhosis and fulminant hepatic failure. Deposition of copper in peripheral corneal Descemet’s membrane was detected as golden brown pigmentation: the Kayser-Fleischer ring.

**Juvenile Rheumatoid Arthritis**

Juvenile rheumatoid arthritis, is the most common type of arthritis in children under the age of 17. The clinical finding of this disease includes White eye, Severe uveitis, Posterior synechiae, Cataract and band keratopathy.

**Sturge Weber Syndrome**

Sturge-Weber syndrome (SWS) is a rare, congenital condition involving the brain, skin, and eye.

Port-wine stains or nevus flammeus in SWS are well-demarcated red macular stains present at birth. Facial PWS may involve only the forehead and upper eyelid following the path of the ophthalmic branch of the trigeminal nerve (20%). Concomitant involvement of the maxillary or maxillary and mandibular branch occurs in many patients (2-23%). Bilateral lesions can be seen in 10-30% of patients.

Glaucoma and choroidal hemangioma are the most common ocular manifestations. Both the conditions are usually ipsilateral to the facial PWS. Increases in the episcleral venous pressure and developmental anomalies in the anterior chamber angle have been considered to be the main causal factors for the glaucoma associated with SWS. Choroidal hemangioma is usually seen as a red, flat to moderately elevated mass producing a classic “tomato ketchup” appearance on fundoscopic examination. Other ocular abnormalities that have been reported in SWS include dilatation and tortuosity of conjunctival and episcleral vessels, buphthalmos, iris heterochromia, optic disc coloboma and cataract.

**Neurofibromatosis**

Neurofibromatosis (NF) is one of the most common genetic disorders. Inherited in an autosomal dominant fashion, this phacomatosis is classified into two genetically distinct sub types characterized by multiple cutaneous lesions and tumors of the peripheral and central nervous system.
Neurofibromatosis 1 (NF1)

First symptoms observed in NF1 patients are usually cutaneous manifestation. Café-au-lait spots usually develop in childhood and are found in almost all patient. Café-au-lait spots usually present as light brown spots of about 10 to 40 mm in diameter with an ovoid shape and poorly circumscribed borders. Presence of more than 6 Café-au-lait spots is defined as strong diagnostic criterion for NF1, a characteristic auxiliary and/or inguinal freckling, usually develops subsequently to Café-au-lait spots seen in most of the patients. Eyelids with neurofibromas typically feel like a ‘bag of worms’ when palpititated. Finally pigmented hamartomas of the iris, so called Lisch nodules, which appear smooth and elevated with a clear to brownish-yellow coloration on slit lamp examination have to be mentioned as a characteristic ophthalmologic feature of NF125. Retinal astrocytic hamartomas are benign tumors of the retinal nerve fiber layer that can present bilaterally involving the optic nerve and posterior pole, with multiple peripheral lesions extending to the anterior retina.26

Neurofibromatosis 2 (NF2)

These tumors are usually appears in on and around the vestibular branches of auditory nerve. These tumour can compress the associated nerves and can causes severe pain and increase intra cranial pressure. Optic atrophy may be seen in patients with papilledema, recurring papilledema or direct optic nerve compression typically secondary to increased intracranial pressure (ICP). Further symptoms can be sudden onset of tinnitus. Juvenile posterior subcapsular lenticular opacity and peripheral cortical cataracts present bilaterally in 80% to 85% of NF2 patients and, in most cases, may be the first sign of NF227

In general, patients with NF 1 and NF 2 should undergo yearly neurologic and ophthalmologic examinations

Von Hippel-Lindau Syndrome

Von Hippel-Lindau (VHL) disease is a rare, autosomal dominant syndrome that is associated with the development of tumors in a variety of organ systems, most commonly hemangioblastoma of the central nervous system and retina28. VHL affects 1 in 36,000 live births and its inheritance pattern occurs in an autosomal dominant fashion,. Retinal hemangioblastomas are arises very frequently in these patients. Sometimes they are first manifestation of symptoms. Complications of retinal hemangioblastomas include blindness or severe visual deficits in 5–8% of VHL patients. The disease usually occur at periphery or optic nerve which can lead to symptoms due to the accumulation of sub retinal fluid and development of hard exudates in the macula

Tuberous Sclerosis

This is a complex multi systemic neurocutenious genetic condition which is autosomal dominant in nature. The most common characteristic features are hamartomas which affect multiple organ including skin, central nervous system, heart, lungs and kidney.

The condition affects one in every 6,000 to 10,000 individuals and can affect both sexes and all ethnic groups equally.30

Clinical Manifestation: Skin lesions are detected in all ages and affect more than 90% of TSC patients.31 Hypopigmented macules which are usually present from the time of birth, is the important clinical manifestation. The most macules are hypo pigmented and in leaf shape the so called “ash-leaf”

Renal angiomyolipomas are extremely common benign tumors in TSC patients, observed in 80% of cases. They progressively enlarge from the first years of life, with an obvious growth during adolescence or early adulthood and stop enlarging in the elderly in about 30% of cases.32 Retinal hamartoma can be present in 30% to 50% of patients and tends to be bilateral and multiple, becoming apparent during infancy. Patients can also be presented with hypo pigmented macule in the retina, which generally corresponds to the hypo pigmented macules seen on the skin.

Conclusion

This article describes in short the complete guide to ocular manifestation of few paediatric diseases thus encouraging the interdisciplinary interaction between eye care practitioner and pediatrician.

Conflict of Interest: Nil
Source of Funding: Self

Ethical Clearance: Taken from Ethics committee

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Relationship Marketing in Healthcare: A Literature Review Analysis of Past, Present & Future in Private Hospitals

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ABSTRACT

Purpose: Although traditional marketing constitutes major portion of promotional strategies formulated by organizations, new paradigms like relationship marketing is increasing its share consistently. This paper aims to delineate the literature work in the area of relationship marketing so that its constructs can be understood in better manner with respect to the healthcare sector especially for private hospitals.

Design/Methodology/Approach: Data for this study has been collected through various online databases. Collected literature was then analyzed for relevance to topic, citations per author, year wise analysis, interrelations and collaboration patterns using Bibexcel and VOSviewer.

Research Limitations/Implications: The systematic plotting of relationship marketing literature helps to graphically demonstrate the evolution of publications over a period of time and to identify areas of present-day research interests and potential directions for future research. In short it will provide research gaps which can be explored by researchers.

Originality/Value: This paper is a contribution to the rapidly burgeoning and detonated literature on relationship marketing as it attempts to clarify the concept by understanding its various elements and conceptual relationships by studying the past literature on the topic. It focusses on satisfaction and loyalty effects of relationship marketing especially in healthcare sector.

Keywords: Relationship marketing, Patient satisfaction, Patient loyalty, Healthcare management

Paper type: Literature review analysis

Introduction

Indian healthcare sector, one of the fastest growing service sector, is anticipated to advance at a CAGR of 22.87 per cent during 2015 - 2020 to reach USD280 billion. There is massive scope for enhancing healthcare services dispersion in India, thus presenting plenty of opportunities for development of the healthcare industry. The medical services in Indian are more economical; which is also one of the reasons for the rise in India’s medical tourism, drawing patients from various countries of the world. This flow in patients from across the world has increased the responsibility of private hospitals to provide international quality service and grow a long term relationship with customers. Healthcare in India if analyzed using Porter’s five forces, will be depicted as below.

Competition has always made it mandatory for service providers to improve the service quality. Threat of new competitors, competitive rivalry and negotiating power of customers are the key forces which drive the healthcare sector in India (¹).

Relationship marketing can be defined for healthcare sector using constructs like satisfaction, service quality/performance, level of job satisfaction, trust, communication/interactivity, working conditions, relationship quality, relational contact, affective conflict,
commitment, value creation, benevolence, care and concern, recommendation, repatronization, ethical profile, opportunism, organizational/firm performance, patient behavior, management/administration. It is essential to comprehend the principles of relationship marketing like strategy, segments, personas, experience maps, promotional planning, communication touch points, measurement, and optimization for identifying and developing strategies of relationship marketing.

Also the concepts of customer satisfaction, commitment, confidence benefits, and social benefits assist to considerably contribute to relationship marketing outcomes in services.

To understand the meaning of relationship marketing few definitions have been shown in table format as below (Table 1)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Perspective</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Berry (1983)(^6) from services perspective</td>
<td>“Relationship marketing is attracting, maintaining and - in multi service organizations - enhancing customer relationships”</td>
</tr>
<tr>
<td>2.</td>
<td>Morgan and Hunt (1994)(^\ast) from commitment &amp; theory perspective</td>
<td>“Relationship marketing refers to all marketing activities directed at establishing, developing, and maintaining successful relational exchange in supplier, lateral, buyer, and integral partnerships”</td>
</tr>
<tr>
<td>3.</td>
<td>Gronroos (1994)(^7) from globalization of business perspective.</td>
<td>“Relationship marketing is about mutually beneficial exchanges and fulfillment of promises by both parties in a series of interactions over the lifetime of their relationship”</td>
</tr>
<tr>
<td>4.</td>
<td>Evans &amp; Laskin (1994)(^8) from Business to business perspective</td>
<td>“Relationship marketing is the process whereby a firm builds long-term alliances with both prospective and current customers so that both seller and buyer work toward a common set of specified goals”</td>
</tr>
<tr>
<td>5.</td>
<td>Berry (1995)(^9) from services customer’s perspectives</td>
<td>“Relationship marketing allows service providers to become more knowledgeable about the customer’s requirements and needs. Knowledge of the customer combined with social rapport built over a series of service encounters facilitate the tailoring or customizing of service to the customer’s specifications”</td>
</tr>
<tr>
<td>6.</td>
<td>Sheth and Parvatiyar, (1995)(^10) from customer and supplier perspective</td>
<td>“The willingness and ability of both consumers and marketers to engage in relational marketing will lead to greater marketing productivity, unless either consumers or marketers abuse the mutual interdependence and cooperation”</td>
</tr>
<tr>
<td>7.</td>
<td>Mollah (2014)(^11) from retail customer perspective</td>
<td>“The core function of Relationship Marketing is to providing high quality product and services, and committed in providing timely, trustworthy information to the customer which result in mutually benefits by remaining loyal to the organization”</td>
</tr>
</tbody>
</table>

The above table illustrates definitions of different authors from various perspectives. Major perspective to study relationship marketing is from services perspective.

Bibliometric analysis is a research method using quantitative and statistical analyses to define spreading patterns of research articles with a given topic and a given time period\(^12\). Bibliometric analysis was defined by Pritchard as the application of mathematics and statistical methods to books and other media of communication\(^13\).

**Material and Method**

There are two bibliometric methods used by different authors, first one is citation analysis, a way of measuring the relative importance or impact of an author, an article or a publication by counting the number of times that author, article, or publication has been cited by other works. Second bibliometric method used by authors is content analysis which is used to quantify and analyze the presence, meanings and relationships of certain words, themes, or concepts. Citation analysis can again be performed in two different ways; backward citation analysis and forward citation analysis\(^14\). Backward citation analysis is the way in which article of current year is analyzed for articles cited by that article. For example article published in 2018 may have cited many articles published before 2018. In case of forward analysis an article is analyzed for its citation in other
papers. For example article published in 2004 may have been cited in other articles published after 2004.

In this paper, forward citation analysis was used for co-citation network analysis. For this paper, title, author’s information, citation, abstract and keywords of the literature are studied as data. Data for this paper has been collected through Scopus databases. This study restricted the article publication from the years 2004-2018. This period was chosen for the research as it will depict more current or updated details in the research. But to analyze the overall work in the area of relationship marketing, the period from 1996 to 2019 was considered. Network analysis can aid in clarification of the relations among different items by underlying a network of nodes and links through which information or relationships move. This paper carried network analysis in order to create a network with the nodes that represent research articles, keywords, or countries relating to relationship marketing literature. Centrality of nodes is the method used to assess the importance of nodes and its influence.

Network analysis in this paper was carried using Bibexcel and VOSviewer. Collected literature database is then analyzed for relevance to topic, citations per author, year wise analysis, interrelations and collaboration patterns.

Results & Discussion

Article Performance: Research showed that United States is the top country which produced 35 articles in Scopus whereas India has produced only 3 articles in the area of relationship marketing. When the data was analyzed using VOSviewer for understanding the link between countries for authors and for co-citations in relationship marketing specific to healthcare, it showed that though United States is ranked highest in producing articles, United Kingdom came top when co-citations were considered (Fig. No 1).

![Figure 1: Citation link between countries](image)

The figure 1 shows circles which represent countries. The size of circle represents number of articles from that country. Colors of the circles are representative of cluster group to which the respective country belongs to. Here in this figure there are four clusters which are formed on basis of closeness of keywords in the articles. The above figure is displaying link between 12 countries where as the 111 articles from Scopus belongs to 34 countries in all. But when the citation was limited to at least two per document, the number got reduced to 21 and out of these only 12 had higher total link strength. At the same time when the overlay or distribution of country wise citations was studied, it was found that maximum number of papers was cited around 2005, very few have been cited around 2010 and only handpicked articles were cited after 2015.

Author Performance: Author performance was studied using Bibexcel and VOSviewer. The research showed that very few authors have published papers on the area
relationship marketing in healthcare after 2015. Many of them have published articles in the period of 2004 to 2012. This gives clear indication that in healthcare sector, relationship marketing studies are yet to gain importance and pace which is required by the industry. This figure represents which authors have published their articles in which year relating to relationship marketing in healthcare sector. This analysis is done using VOSviewer software.

Next when the citations of authors have been analyzed per average publishing year, it was observed that articles published on or before 2006 are cited more number of times as compared to articles published in 2010 to 2012 period. Also it can be seen that A. Payne’s work on relationship marketing is cited highly by other researchers working in the area of healthcare.

**Keyword Performance:** VOSviewer was used for analysis of keywords in articles. In the collected 111 articles from the Scopus database, 570 keywords were found overall during co-occurrence analysis. When the number of co-occurrences was limited to minimum three times, only 60 keywords could meet the threshold. From theses 60 keywords when keywords non relevant to topic were removed, the link was established.

It was observed that relationship marketing, marketing and healthcare marketing are the few prominent keywords which have occurred more number of times in the articles. As observed in analysis, there are five types of clusters which are developed by VOSViewer on basis of their closeness, centrality and between centrality. The size of the node represents the number of occurrences of that keyword in articles. Large size of the node shows higher the number of occurrences. During this analysis it was found that the total link strength between relationship marketing and healthcare was moderately strong but not as strong as the total link strength between relationship marketing and loyalty. Satisfaction in healthcare cluster is not at all linked with loyalty in first cluster of relationship marketing.

Analyzing the keywords for its occurrences year wise has shown some interesting insights about the current research areas of interest for researchers. The researcher observed that consumer satisfaction in healthcare has not been studied recently but instead emphasis by researchers is given to relationship marketing area where trust, commitment, relationship quality etc. are sub areas of interest. Color of circle represents keyword’s appearance in that specific year.

### Conclusion

Above network analysis and visualizations of the same can be used to conclude that there is scope for further studies with respect to relationship marketing in healthcare specifically. This conclusion can be drawn because out of 3017 documents on relationship marketing from Scopus database only 111 were specific to healthcare sector.

Analysis was done from three specific performances point of view, so conclusion can also be drawn from those three performance analysis as follows:

**Article Performance:** United States is the top country which published around 35 articles in Scopus since 1997 till 2019. United Kingdom emerged as the top ranked country when average citation per article was analyzed. India on the other hand was able to produce only 3 articles in that period on relationship marketing in healthcare.

**Author Performance:** Authors have focused very less on relationship marketing from healthcare perspective. Also their studies are limited to period from year 2004 to 2012; very few authors have studied on the topic after 2014. It can be concluded that whatever work has been done till date by authors, their co-citations and citations are limited due to specific studies and not linking different aspects of relationship marketing together in healthcare.

**Keyword Performance:** Relationship marketing found highest link strength with trust, which means many authors have studied them together. Weakest link of relationship marketing was seen with consumer satisfaction and patient satisfaction. Along with this it can be concluded that patient satisfaction, service quality in healthcare and structural equation modelling are few of the newly emerging areas of interest for authors.

**Conflict of Interest Statement:** The authors declare that there is no conflict of interest.

**Source of Funding:** This research is self-funded research.

**Ethical Clearance:** This paper is on bibliometric analysis, and due which it does not require ethical clearance as per discussion with conference convenor.
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Testing Preparedness of EMS Personnel in Identification and Decompression of Tension Pneumothorax using High Fidelity Simulation—A Pilot Study

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ABSTRACT

Introduction: Tension pneumothorax is a life threatening medical emergency that can quickly deteriorate the cardiopulmonary function leading to high chance of mortality. A tension pneumothorax occurs when the patient cannot compensate during respiration leading to air filling in the pleural space. This leads to collapse of lung and the pressure begins to compress the heart. The diagnosis is primarily clinical and hence depends on the judgement of the Emergency Medical Services (EMS) personnel. Hence, the confidence level of the EMS personnel in tackling this dire emergency is of utmost significance. While needle decompression can be lifesaving, if performed incorrectly, complications can be life threatening including serious penetrating cardiac injury leading to death. High Fidelity Simulation offers an excellent opportunity to practice diagnosing this emergency as well as honing the skill of needle decompression in a safe environment.

Objective: The study aims to test preparedness of EMS personnel in identifying and managing tension pneumothorax by performing needle decompression using high fidelity simulation.

Methodology: A high fidelity simulation manikin, was utilized for preparing three simulated clinical experiences of trauma leading to Tension Pneumothorax. The EMS students were already aware of Tension Pneumothorax - diagnosis and management through didactic lectures and practicals conducted in low fidelity skill stations.

Three groups (Group 1, 2 & 3) of six students each performed the simulation and were evaluated using the advance course protocol of patient assessment by International Trauma Life Support (ITLS). The students were also evaluated on the accuracy of diagnosis and the correctness of the technique of needle decompression. The time taken for diagnosis and further to successfully achieve decompression. The entire simulation scenario was video recorded with consent and later evaluated by two different trainers to reduce bias.

Result: Students from Group 1 could not diagnose tension pneumothorax in the simulated patient. Based on the findings Group 2 and 3 diagnosed tension pneumothorax.

Discussion: The participants in the study were already well versed with the subject of Tension pneumothorax by lectures and practical sessions conducted at low fidelity skill stations. Yet when confronted with a realistic simulation scenario on tension pneumothorax Group 1 could not diagnose the condition while Group 3 took too long to arrive at a diagnosis by which time the simulated patient’s condition had worsened.

Conclusion: The study highlights the lack of preparedness amongst trained EMS personnel in handling tension pneumothorax cases. This is a concerning issue, yet high fidelity simulation offers a platform to learn the concept of tension pneumothorax in a realistic environment. The study being a pilot initiative would need data collection with a larger sample size to arrive at more concrete evidence of the utilization of high fidelity simulation in training EMS personnel. Additional simulation workshops could be done to assess other skills and integration of more simulation into EMS training may be useful, especially for rarely performed time critical life-saving skills.

Keywords: Tension pneumothorax, needle decompression
Introduction

Tension pneumothorax is a life threatening medical emergency that can quickly deteriorate the cardiopulmonary function leading to high chance of mortality. 1 Pneumothorax is found in both military and civilian settings and is often a preventable cause of death. 2 A tension pneumothorax occurs when the patient cannot compensate during respiration leading to air filling in the pleural space. This leads to collapse of lung and the pressure begins to compress the heart. The patient’s inability to maintain oxygenation leads to rapid deterioration. 3

The presentation of pneumothorax is often masked by multiple factors and so diagnosis remains potentially challenging. 4 Time is of essence in a case of tension pneumothorax and prompt decompression has proven to be lifesaving. The diagnosis is primarily clinical and hence depends on the judgement of the Emergency Medical Services (EMS) personnel. Hence, the confidence level of the EMS personnel in tackling this dire emergency is of utmost significance. In most cases, the EMS personnel have to perform needle decompression immediately after diagnosis on the scene itself. 5

While needle decompression can be lifesaving, if performed incorrectly, complications can be life threatening including serious penetrating cardiac injury leading to death. 6 In most cases, EMS personnel learn the diagnosis & emergency management of tension pneumothorax through didactic lectures and have less chance of observation during clinical postings. Such procedures are done on actual patients and can cause harm to them. 7 High Fidelity Simulation offers an excellent opportunity to practice diagnosing this emergency as well as honing the skill of needle decompression in a safe environment. Simulation is utilized for both, formative and summative evaluation of the knowledge, skill and attitude of EMS personnel in this kind of emergency.

Objective

The study aims to test preparedness of EMS personnel in identifying and managing tension pneumothorax by performing needle decompression using high fidelity simulation.

Methodology

A high fidelity simulation manikin, was utilized for preparing three simulated clinical experiences of trauma leading to Tension Pneumothorax. The EMS students were already aware of Tension Pneumothorax - diagnosis and management through didactic lectures and practicals conducted in low fidelity skill stations.

Three groups of six students each performed the simulation and were evaluated using the advance course protocol of patient assessment by International Trauma Life Support (ITLS). Each simulation session lasted for 10 minutes. The session was followed by a structured debriefing session of 20 minutes. The students were also evaluated on the accuracy of diagnosis and correctness of the technique of needle decompression, the time taken for diagnosis and further to successfully achieve decompression. The entire simulation scenario was video recorded with consent and later evaluated by two different trainers to reduce bias. Seven parameters in the ITLS protocol were utilized to assess the patient assessment.

Result

Table 1: Patient Assessment

<table>
<thead>
<tr>
<th>Action</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scene Size up</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>General Impression</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Level of Consciousness</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Looked for bleeding</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Airway management</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Breathing</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Circulation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Rapid Trauma Survey (Head to Toe Examination)</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table no. 1 depicts that students from all three groups assessed the scene safety, mechanism of injury which could lead to multiple life threatening injuries. They assessed level of consciousness and checked for any external bleeding.

Students of Group 1 applied cervical collar and transported the patient in ambulance. They did not check airway, breathing and also did not assist ventilations. They could not diagnose tension pneumothorax.

Students from Group 2 and 3 assessed airway, found breathing to be inadequate and so performed assisted
ventilation. They checked for circulation, and found absent peripheral pulses and absent breathing sounds on affected side. Based on the findings, they diagnosed tension pneumothorax. They performed needle decompression on the scene correctly and the condition of simulated patient improved.

Table 2: Reaction time for diagnosis

<table>
<thead>
<tr>
<th></th>
<th>Time taken to diagnose Tension Pneumothorax (in minutes)</th>
<th>Time taken to manage by Needle Decompression (in minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Group 2</td>
<td>1.34</td>
<td>0.40</td>
</tr>
<tr>
<td>Group 3</td>
<td>4.00</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Table no. 2 shows that students of Group 1 could not diagnose the condition in the simulated patient. Students of Group 3 took longer time than students of Group 2 (4.00 mins vs 1.34 mins) to diagnose and manage tension pneumothorax in the simulated patient.

Discussion

The participants in the study were already well versed with the subject of Tension pneumothorax as they had attended lectures and practical sessions conducted at low fidelity skill stations. Yet when confronted with a realistic simulation scenario on tension pneumothorax, one group could not diagnose the condition while one group took too long to arrive at a diagnosis by which time the simulated patient’s condition had worsened. Traditional lecture and practical sessions help in conceptual understanding and practicing the technique. But amalgamating the same knowledge & skill and applying it in real clinical situation is difficult. There is a definite gap which was reflected in the simulation scenario.

Real life clinical situations require high degree of situational awareness which can be gained by repetitive practice on a high fidelity manikin. The manikin offers a safe learning environment and the software allows for simulating varied case scenarios to acclimatize the student to the real life management of tension pneumothorax. This pilot study emphasizes the need for more hands on practice for critical life threatening emergencies using High fidelity simulation manikins. High fidelity simulation provides objective data in a realistic environment for assessment of preparedness of EMS personnel. This objective data can be used in formative assessments to improve the skill set of the student and in summative assessments to judge the ability of the student in tackling emergencies.

Conclusion

The study highlights the lack of preparedness amongst trained EMS personnel in handling tension pneumothorax cases. This is a concerning issue, yet high fidelity simulation offers a platform to learn the concept of tension pneumothorax in a realistic environment. The study being a pilot initiative would need data collection with a larger sample size to arrive at more concrete evidence on the utilization of high fidelity simulation in training EMS personnel. Additional simulation workshops could be done to assess other skills and integration of more simulation into EMS training may be useful, especially for rarely performed time critical life-saving skills.

Source of Funding: Self

Conflict of Interest: Nil

Ethical Clearance: Taken from IEC, SIDU committee

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Integrating Flipped Classroom Technique with High Fidelity Simulation for Teaching Hemorrhagic Shock to EMS Students at Pune, India—A Pilot Study

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¹Director, ²Medical Officer, Academics, ³Adjunct Faculty, Symbiosis Centre for Health Skills, Symbiosis International (Deemed University), Pune, India

ABSTRACT

Introduction: Shock is a state of circulatory collapse leading to decreased perfusion of the tissues which in turn leads to lack of oxygen and nutrients to the cells and thereby hampers the cellular function. EMS students are presently taught the concept of shock through traditional lecture and case discussion method. Clinically relevant topics can be alternatively taught via a flipped classroom technique wherein the traditional learning environment is reversed by delivering instructional content outside the classroom. A novel approach to evaluating the effectiveness of flipped classroom would be to integrate it with high fidelity simulation which relies on experiential learning.

Objective: To integrate flipped classroom technique with high fidelity simulation for teaching hemorrhagic shock to EMS students and measuring their satisfaction on a pilot basis.

Methodology: A comprehensive reading material on the subject Hemorrhagic Shock was circulated amongst 200 EMS students two weeks prior to the planned flipped classroom session. 50 students were randomly chosen to participate in High fidelity simulation scenario based flipped classroom session. Students were divided into batches of seven each. The simulation pre-brief involved a brief synopsis of shock in general with special focus on hemorrhagic shock. Each simulation session lasted for approximately 10 minutes followed by structured de-briefing for 20 minutes. A feedback questionnaire was designed to gauge participant response on the high fidelity simulation session as a flipped classroom exercise. The questionnaire was administered to the students immediately after the session.

Result: The students gave extremely high rated feedback on the structure, organization and effectiveness in diagnosing and managing a case of hemorrhagic shock. It is seen that the students were satisfied with the prebriefing and overall preparation and understanding of the scenario.

Conclusion: The study is limited by its sample size and singular event, but offers significant perspective to replicate a long term effectiveness study amongst a larger cohort of EMS students.

Keywords: Flipped classroom technique, high fidelity simulation, hemorrhagic shock

Introduction

Shock is a state of circulatory collapse leading to decreased perfusion of the tissues which in turn leads to lack of oxygen and nutrients to the cells and thereby hampers the cellular function.¹ Hemorrhagic Shock is caused by blood loss resulting in insufficient blood within vascular system. Hemorrhage can either be external or internal or in some cases both.

Blood loss is the most common emergency in case of Trauma². The Emergency Medical professionals are expected to clinically diagnose and manage the cases of trauma which in most cases can be life threatening.³ External bleeding can be easily managed as the source of bleeding can be conveniently visualized. The real challenge in the prehospital scenario lies in the assessment and management of internal hemorrhage where it is difficult to pinpoint the source. Hence, the clinical acumen of the EMS professional plays a great role.⁴

EMS students are presently taught the concept of shock through traditional lecture and case discussion method. Clinically relevant topics can be alternatively
taught via a flipped classroom technique wherein the traditional learning environment is reversed by delivering instructional content outside the classroom. The classroom time is then utilized for practical learning via case studies or assignments. A systematic review of the effectiveness of flipped classroom in medical education concluded that it is a promising teaching approach to increase learner’s motivation and engagement.5

However, conflicting studies have concluded that the flipped classroom technique did not add value or improve student satisfaction6.

A novel approach to evaluating the effectiveness of flipped classroom would be to integrate it with high fidelity simulation. Simulation focuses on hands on practical training in a realistic environment based on experiential learning, where greater time is spent in reflection by debriefing.7

**Objective**

To integrate flipped classroom technique with high fidelity simulation for teaching hemorrhagic shock to EMS students and measuring their satisfaction on a pilot basis.

**Methodology**

A comprehensive reading material on the subject Hemorrhagic Shock was circulated amongst 200 EMS students two weeks prior to the planned flipped classroom session. 50 students were randomly chosen to participate in High fidelity simulation scenario based flipped classroom session. Students were divided into batches of seven each. The simulation pre-brief involved a brief synopsis of shock in general, with special focus on hemorrhagic shock.

Seven group of students participated in seven different case scenarios portraying hemorrhagic shock. The students were also oriented to the features of the high fidelity manikin to ensure smooth flow during the scenario. A facilitator was present during the simulation session to answer any student queries. Students were expected to perform patient assessment and emergency management on a high fidelity manikin, Apollo, as per the ITLS patient assessment algorithm. Each simulation session lasted for approximately 10 minutes followed by structured de-briefing for 20 minutes. The debriefing involved reflection of the experience and sharing of feedback regarding the simulation. This was followed by recapitulation of the concept of hemorrhagic shock in relation to the simulated case. A feedback questionnaire was designed to gauge participant response on the high fidelity simulation session as a flipped classroom exercise. The eight item questionnaire was administered to the students at the end of the session. Six items required response on a five point Likert scale (1 indicating Do not agree and 5 indicating Strongly agree). Two items required descriptive response on the satisfaction with the new technique. The questionnaire was administered to the students immediately after the session. The data was tabulated and analyzed. Content analysis was conducted on the descriptive responses.

**Result**

The scores obtained on each item of the questionnaire is given below:

![Figure 1](image-url)
As depicted in Figure 1, it is seen that the students were satisfied with the prebriefing and overall preparation and understanding of the scenario. The realism of the scenario had lowest rating as compared to other statements. This may probably be due to the fact that they were all not exposed to learning conceptual topic like shock through high fidelity simulation and hence had difficulty adjusting to the same.

Discussion

The students gave extremely high rated feedback on the structure, organization and effectiveness in diagnosing and managing a case of hemorrhagic shock. The students appreciated the helpfulness of the prebriefing as well as the hands-on approach provided by the simulation to test the emergency response. The descriptive questions yielded interesting perspectives on the effectiveness of flipped classroom technique. Majority students found the reading material provided in advance very useful during the actual case scenario. Most students appreciated the physiological fidelity offered by the manikin in mimicking key physiological parameter changes in a hemorrhagic shock event. Few students found the simulation environment challenging, being their first encounter. Nevertheless, they requested for greater exposure and more sessions with the new flipped classroom high fidelity simulation technique.

Flipped classroom technique offers an exciting opportunity to change the way clinical cases are taught. With increasing scope of syllabus and restricted time available for covering the vast subject, flipped classroom saves valuable classroom time for practical learning. Combining the technique with high fidelity simulation is a synergistic approach offering deliberate experiential learning opportunity to the student. The student, comes prepared with the background on the subject and has greater situational awareness during the classroom session.

Conclusion

The study is limited by its sample size and singular event, but offers significant perspective to replicate a long term effectiveness study amongst a larger cohort of EMS students. Flipped classroom by high fidelity simulation has shown high degree of student satisfaction in a single event model. Long term studies can throw more light on its effectiveness as an andragogy.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from IEC, SIDU committee

REFERENCES

Factors Affecting the Demand of Health Insurance in India—
A Systematic Review

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ABSTRACT

Introduction: Insurance penetration in India is close to 16% which means that only very less percentage of the population is covered under some form of Insurance which includes Government Insurance Schemes, Employer based insurance, Private health insurance and Community based insurance schemes. The condition is pitiful, as a huge part of our population does not use health insurance and pay out of pocket to finance their medical expenditures. Such scenario makes it essential to study factors affecting demand of health insurance in India.

Aim and Objectives: The study aims to bring out various factors affecting the demand of health insurance in India. The objectives include understanding the factors influencing health insurance purchase decision of health insurance.

Methodology: An exhaustive & comprehensive review of literature was carried out from various studies from all across India & developing countries through online electronic databases. The databases included Google scholar, EBSCO, JStor & website of related nationalised agencies and IRDA.

Results: The major factors affecting health insurance were found to be low awareness, income, education, health seeking behaviour, availability of healthcare facilities and trust in health insurance companies.

Conclusion: To make health insurance spread across all segments of India both supply and demand determinants are important. Demographic factors along with socio economic factors play a major role in health insurance penetration.

Keywords: Health Insurance, supply and demand of health insurance

Introduction

Universal healthcare is in the agenda of Indian government since long. Universal healthcare means that appropriate healthcare facilities should be made available to everyone. Such conditions range from ensuring healthy and safe working conditions, nutritious food and availability of affordable and accessible health services.

The total healthcare expenditure in India accounts for a 6% to Gross Domestic Product (GDP) of which 66.9% of its composition consists of Out-of-Pocket (OOP) payments according to the World Health Organization (WHO) report compared with 10-12 % of GDP spent on healthcare by the Developed countries.¹²

The World Bank in a 2012 report says that the healthcare expenditure was one of the major cause of poverty in India. Nearly 65 % of the India’s poor get into debt and 3% fall below poverty line each year because related expenses. In such scenario Health insurance is the only viable option to make healthcare available and accessible.

The public health spending in India is equal to 1% of GDP, OOP being the pre dominant mechanism for financing healthcare in the country. Insurance penetration in India is close to 12% which means that only 12% of the population is covered under some form

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of Insurance which includes Government Insurance Schemes, Employer based insurance, Private health insurance and Community based insurance schemes.

Nearly 40% of hospitalised patients sell assets or borrow money to afford treatment and an average of 24% fall further down the poverty trap in this process. One of the reasons for lack of a proper health-seeking behaviour within the poor community is the expensive medical treatment especially at private hospitals and the poor facilities available at public facilities. There is a close relationship between the health conditions of the people and the economic growth of the country in which they live. It becomes necessary for the government to ensure affordable services for the Universal Health Care to improve and maintain their health well-being. Some of these factors prove that health micro insurance is critical to reduce poverty and improve household conditions in poor and developing countries.

Health Insurance is widely accepted as the most important measure towards UHC (Universal Health Coverage). The growing technical and managerial capacity of health insurance is widely recognized. With regulations and increasing role of authorities like IRDA, ROHINI the previously unregulated HI (Health Insurance) market is much regulated now and heading towards standardization. With the growing Indian middleclass, the economic growth of the country by 2020 projects educated and aware population with high purchasing powers.

On the other side with rapid urbanization, rapid expansion of government sponsored health insurance schemes, technology integration and standardization of healthcare processes, the penetration of health insurance is obvious. The factors affecting the consumer’s choice and readiness to purchase insurance play an important role in the percolation of Health insurance plans. With increasing number of insurance products the buyer having purchasing power will purchase only if the products of his choice are available. Therefore there is a need to study factors leading to purchase of health insurance. The consumers perspective along with the insurers perspective needs to be analysed to develop and deliver insurance products suite to the need of the all segments of population.

Awareness about Health insurance products in India is identified as one of the barrier in the in the widening health insurance coverage. The supply and demand sides both the play an important role and are a matter of grave consideration.

Aim and Objectives

The study aims to bring out various factors affecting the penetration of Health Insurance in India

Objectives of the Study

1. To understand the factors influencing the purchase decision of health insurance policies.
2. To identify the supply and demand determinants affecting the scale up of Health Insurance.
3. To study the factors acting as hindrance to health insurance purchase.

Methodology

An exhaustive & comprehensive review of literature was carried out form various studies from all across India & developing countries through online electronic databases. The databases included Google scholar, EBSCO JStor& website of related nationalised agencies and IRDA.
Literature Review

The first evidence of liberalization of insurance sector was seen in 1986 where private players entered into the market. The private insurance plans were initially launched by public non-life insurance companies. Further in 1999 the health insurance market was opened for foreign private players. Later in 2001, a regulation was passed which approved the entry of private non-life insurance companies to venture into the health insurance business in India. With the introduction of TPAs in 2007 the administrative processes related to hospitalisation have become more standardised and convenient. Parallel to the traditional claim settlement procedure, direct cashless facility is attracting customers more in the empanelled hospitals by the insurance companies for the health claims.\textsuperscript{11}

As the number of products and companies are expanding there is a dire need to study determinants of health insurance. Thompson and Rao list the most prevalent variables: gender, marital status, Religion/ethnicity, education, income level, age, geographical mobility, and family size.\textsuperscript{12,13}

Studies carried out in various part of India as well as globally have shown that the major contributing factors to the health insurance are the age, gender, income marital status and occupation. On the supply side of health ease of reimbursement and other administrative processes play a dominant role. Studies from the developing countries show that income, education and health risks are the major factors affecting purchase of health insurance, Several studies support this fact.\textsuperscript{14,15} Researchers found low awareness about the health insurance among the insured as well as the insured categories. Furthermore, he states that on the supply side the suppliers of health insurance are less motivated which can be directly correlated with the less incentive for the insurance advisors.\textsuperscript{16}

Healthcare expenses, coverage of illness and the premium are the significant factors affecting the purchase of plan among the aware group. Eight qualitative factors which affect health insurance purchase decision are mainly cost, quality, accessibility, coverage of illness, coverage of services, trust, illness and knowledge about Health Insurance. Studies showed a positive association between Health Insurance purchase decision and healthcare expenditure.\textsuperscript{17}

With respect to Community based health Insurance, India’s experience with a large CBHI (Community based health Insurance scheme) Programme Yeshawini scheme being run by Karnataka is significant. The analysis based on the primary survey of 4109 households studied education, gender equity, social equity and economic equity. Social equity and education were found to be the most significant factors. This study also emphasized that a well designed marketing package is necessary to promote enrolment and renewal.\textsuperscript{17}

In a study on Customers perception towards health insurance in Bardoli and Mandvi region studies correlation between income and interest of an individual towards purchase of health insurance. Study demonstrated a strong association between income and interest.\textsuperscript{20} Researchers studied willingness to pay for health insurance in the city of Coimbatore. The study also explored various factors which act as impediments to join health insurance. Majority out of the 225 respondents were willing to join Health Insurance. Moreover, significant association exists between age,education, monthly income and willingness. The study also states that the tax exemption component of the health insurance along with the premium greatly affects buyer’s behaviour.\textsuperscript{21}

The studies carried out in the developing country as well as in the developed country show variation in some aspects. In developing countries the findings showed that the level of out of pocket expenditure as well as affordability play a crucial role in penetration of Health Insurance.\textsuperscript{21,22} Francis Mhere, Midland State University studied health insurance determinants in Zimbabwe. The study revealed that relation between employment status of the household head as well as the type of job one performs as in white collar or blue collared was insignificant. However, there was a strong correlation between health insurance purchase and education. Age & income were another parameters which significantly impact Buyer behaviour.\textsuperscript{23}

Studies also revealed seven major factors, which act as barrier to the subscription of health insurance. These factors were lack of funds, lack of awareness, lack of willingness, poor network of intermediaries, lack of trust and inaccessibility of healthcare services. This were in addition to the other demographic factors.\textsuperscript{23}
Findings & Discussion

This review brings out important determinants affecting penetration of Health Insurance and reveals factors that affect the purchase of health insurance.

The major factors affecting health insurance were found to be:

- Awareness and understanding of health insurance
- Income
- Education
- Health seeking behavior
- Availability of healthcare facilities
- Trust in health insurance companies

The study included in the review were from various part of India and differed slightly in the methodology. Age & sex were found to be significantly related to uptake of the scheme. Also, the review suggests younger individuals were more willing to pay compared to older individuals. Similarly, males were more willing to purchase health insurance as compared to females.

Awareness and understanding of health insurance was gain found to be the significant determinant. Low awareness regarding the policy and benefits act as hindrance.²⁶

Trust: Many a times the insurance claims are rejected due to some small technical reasons. Also the conditions included in insurance policy contracts is not negotiable and these are binding on consumers. There is no analysis on fair and unfair price. Given that insurance companies are large, almost monopoly setting the consumers is treated as secondary, and they do not have opportunity to negotiate the terms and conditions of a contract.²⁶

Need of Ethnographic Research: There is also a need of ethnographic research through case studies to find out the major factors acting on supply and demand side of the health insurance²⁶.

Role of Regulators: The use of modern medicine is also an important factor for enrolling into CBHI since the scheme requires the regular use of conventional means of treatment; hence those who use modern medicine have been found to be more willing to pay than those who use other means of treatment.²⁷,²⁸

Product Innovation: Health insurance is typically annual and has to be renewed yearly. Policy, which is not renewed in time lapses and a new policy has to be taken out. Medical conditions detected during the interim period are treated as pre-existing condition for the new policy, which is not fair.

One of the planks on which the insurance has been deregulated is the gain in efficiency and passing on these benefits to the consumers. Providing complete information to the consumer and dealing with claims in a just and expeditious manner is the minimum expected outcome. Consumer organizations have to play very active role in development of the health insurance sector in India.

There are several social issues such as exclusions of sexually transmitted diseases, AIDS, delivery and maternal conditions etc. The companies may charge additional premium for certain conditions. Secondly, the premiums are high and do not differentiate between people living in urban and rural areas where the costs of medical care are different. Thus, the present policy is less attractive to poor and rural people. The tax subsidy provided is also going largely to the rich who are the taxpayers.

Conclusion

The review has brought forth some important determinants in penetration of health insurance. To make health insurance spread across all segments of India both supply and demand side needs to be considered. Demographic factors along with socio economic factors play a major role in health insurance penetration.

Source of Funding: Nil

Conflict of Interest: Nil

Ethical Clearance: IEC of Symbiosis International (Deemed University)

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Usage Intention towards Online Healthcare in Context to Consumer

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ABSTRACT

Introduction: The application of innovative technologies in the area of healthcare services has resulted in improved patient safety, satisfaction, care quality and decreased healthcare costs. The major advancement in the healthcare IT revolution has been the ability to render various healthcare services to consumers through the world-wide web referred to as the “internet”. The potential of online healthcare is based on allowing patients to access real-time information about their treatment and diagnosis for personal decision making without having to visit a healthcare facility. [1]

Objectives: The paper aims to identify the key motivational factors for user intention regarding online healthcare services; and identification of the key consumer acceptances and barriers towards online healthcare.

Novelty/Originality: This study is a unique contribution towards identification of usage intention by integrating constructs from two well-established theoretical models, the Technology Acceptance Model (TAM) and Self Determination Theory (SDT) in the area of online healthcare space.

Materials and Methods: Online survey responses of 150 consumers by coalescing constructs from Technology Acceptance Model and Self Determination Theory has been validated and analyzed through factor analysis using SPSS. In order to provide robustness to the findings, relevant literature related to usage intention of online healthcare has been review and cited.

Results and Discussions: The findings indicated that consumers’ are using various online resources to find answers to their healthcare related queries. Extrinsic motivation contributes around 33% towards consumers’ intention to use online healthcare while intrinsic motivation contributes 24% towards usage intention.

Application: At an academic level, this research provides interesting insights for exploring usage intention of consumers towards online healthcare. Furthermore, the findings can assist healthcare organizations to develop intervention strategies for maximizing benefits for their various online initiatives to achieve high consumer acceptance and positive recommendations.

Conclusion: Both extrinsic and intrinsic motivation have significant impact on the usage intention. However the proposed model did not highlight any relationship between digital literacy and familiarity of usage and comprehension of available online health information.

Keywords: Online healthcare, adoption intention, technology acceptance model

Introduction

Numerous researches have supported the arguments that amongst the various categories of websites searched, healthcare websites are one of them most prominent ones.[2] In view of this rapidly transitioning structure, a considerable challenge faced by the healthcare services and marketing teams is to comprehend the diverse roles
played by the “internet”, keeping in view the mammoth of healthcare websites which get launched on a weekly basis.[3] Furthermore, these websites are the warehouse of information and may offer details related to a product, service, gamified content, advocacy group and at times links to other websites as well.

The article is structured as follows. Foremost the literature on online healthcare, Technology Acceptance Model (TAM), Self Determination Theory (SDT) and eHEALS is discussed. This is followed by the hypothesis formulation and proposed model and then followed by the research methodology used in this study. The consequent sections include Data analysis and findings of the study, and conclude with the theoretical and practical implications.

Motivation has been considered crucial to understand consumer behavior because it is used as a parameter to measure a consumers’ preference for a particular activity, the quantity and quality of effort rendered for a particular activity and the persistence delivered over a time period.

Self Determination Theory (SDT) as explained by motivational theorists develops on the concept that all individuals can either be extrinsically or intrinsically motivated to perform certain actions.[4] Thus being one of the most comprehensive structure for explaining motivation, wellness and the relationship between the two.[5]

Intrinsic motivation is the drive and aspiration of an individual to achieve a task, which is self-driven and not influenced by any external influences. The outcome of intrinsic motivation assures an individual pleasure and satisfaction, post completion of the task. Extrinsically motivated individuals perform a task because of its alleged rewards, values and benefits distinctive from the activity itself.[6] Over and above, researchers Davis et al., 1992[4], explained that extrinsic motivation is highly externally reinforced.

Up till now, studies using SDT to understand motivation in participatory behaviors leading to value creation is not significantly available in existing literature.[7] The two main extrinsic motivators suggested by researchers[8,9,4] include perceived ease of use and perceived usefulness. These two factors have reported to have direct impact on consumers’ intention for usage of a system.[7] Perceived usefulness is an individual’s belief that using a specific information system will increase his or her performance, whereas perceived ease of use is the users’ expectation that the specific information system will be effortless in usage.[10, 19]

The Technology Acceptance Model (TAM) is based on the theory which propounds that an individual’s usage of the system is predicted by his/her intention to use an information technology system which is inclined towards his/her internal attitude and belief of using a system. Furthermore, these internal beliefs are seen as motivational factors for an individual that help drive the individual to accomplish their goals.[11]

The concepts of eHealth literacy has laid the foundation for the development of “The eHealth Literacy Scale (eHEALS)” which is an instrument designed to evaluate consumers’ skills associated with usage of information technology in healthcare and thereby assisting decision makers in planning their healthcare promotional strategies.[12] This 8-item tool has been developed to understand consumers’ perception on ease and ability at finding, comprehending and application of the information gathered electronically on their health issues. The researchers’ identify the need to apply the eHEALS to additional populations’ categories and confirm relationship amongst eHealth literacy and their levels of technology expertise.

The rationale of the current study is to contribute and intensify our understanding of usage intention of consumers towards online healthcare. From a theory building perspective, the study uses the TAM to reflect on consumers’ adoption of online healthcare information/service. In addition to this, this study includes constructs from the SDT and eHEALS and attempts to better explain the association between these constructs (intrinsic and extrinsic motivation, and eHealth literacy) and their impact on consumers’ usage of online healthcare. Lastly, the motivational dimensions of consumer intention may aid healthcare marketing professionals in proposing effective online campaigns.

**Hypothesis Development**

Building from the studies related to SDT, motivational factors which are extrinsic in nature impact consumers’ intention towards its usage. Consumers believe a resource or product or technology to be useful, if they feel that it will enhance their task performance. [13] Thus such consumers are highly motivated to make use of such resources. Similarly, consumers’ with a positive perception about the usefulness of the product
demonstrate a positive usage and behavioral intention. Therefore, it is predicted that:

H1: A positive intrinsic motivation is more likely to favorably influence consumers’ intention towards usage of online healthcare

Identical to extrinsic motivation, intrinsic motivation is anticipated to impact consumers’ usage intention.\[^{14}\]

H2: A positive extrinsic motivation is more likely to favorably influence consumers’ intention toward usage of online healthcare

eHealth Literacy Scale (eHEALS) estimates skills and comfort level of consumers related to eHealth. There does exist a linkage between eHealth literacy and the information technology used.\[^{12}\] However, the potential lies in being able to confidently navigate and identify and comprehend the accurate health information to avoid consequences of misleading and false information\[^{15, 20}\], thus hypothesize that

H3: Consumers with e health literacy have a higher usage intention towards online healthcare

**Proposed Model**

![Proposed Research Model](image)

**Research Methodology**

To validate the proposed model, an online structured survey was conducted for all the identified constructs which have been used in the model. The measurement items were identified from the existing studies and literature and have been modified to fit in the online healthcare context. (Table I.)

Based on convenience sampling, the population under study included 150 responses for age groups ranging from 21 and above. The survey was carried out in metropolitan areas of Bangalore city. For the survey a structured seven-point Likert scale ranging from (1) “strongly agree to (7) “strongly disagree” was created. The questionnaire was bifurcated into two parts. Part A included questions from the various constructs which were included in the proposed model. Part B included the demographic information of respondents’ gender, age in years, educational qualification and number of hours respondents spend online in a day.

**Table I: The measurement items**

<table>
<thead>
<tr>
<th>Item</th>
<th>Source[^{18}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic Motivation</td>
<td>Mun et al. (2006), Baptista and Oliveira (2015)</td>
</tr>
<tr>
<td>Extrinsic Motivation</td>
<td>Thompson S. H. Teo et al. (1998)</td>
</tr>
<tr>
<td>Usage</td>
<td>Thompson S. H. Teo et al. (1998)</td>
</tr>
<tr>
<td>Behavior intention</td>
<td>Gao et al. (2015), Venkatesh et al. (2012)</td>
</tr>
<tr>
<td>eHEALS: The eHealth Literacy Scale</td>
<td>Cameron D Norman (2016)[^{12}]</td>
</tr>
</tbody>
</table>

**Data Analysis**

Exploratory factor analysis was performed to identify the items measuring each of the constructs. Since the established scales have been used for the study, confirmatory factor analysis is not recommended. In factor analysis the factors identified had Eigen value of 1 or more. The total variance explained was 67.35%. The results for the analysis have been tabulated in Table II.

**Table II: Factor extraction results**

<table>
<thead>
<tr>
<th>Variables/Factors</th>
<th>Factor loading</th>
<th>Share of explained total variance (%)</th>
<th>Eigen values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic Motivation</td>
<td></td>
<td>19.679</td>
<td>3.739</td>
</tr>
<tr>
<td>IN1</td>
<td>.642</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN2</td>
<td>.781</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN3</td>
<td>.805</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN4</td>
<td>.799</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN5</td>
<td>.714</td>
<td></td>
<td></td>
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<tr>
<td>IN6</td>
<td>.560</td>
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Extrinsic Motivation

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<tbody>
<tr>
<td>EX1</td>
<td>.725</td>
<td></td>
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<tr>
<td>EX2</td>
<td>.633</td>
<td></td>
</tr>
<tr>
<td>EX3</td>
<td>.738</td>
<td></td>
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<tr>
<td>EX4</td>
<td>.783</td>
<td></td>
</tr>
<tr>
<td>EX5</td>
<td>.543</td>
<td></td>
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<tr>
<td>EX6</td>
<td>.566</td>
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<tr>
<td></td>
<td>17.959</td>
<td>3.412</td>
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Extrinsic motivation analysis

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<tbody>
<tr>
<td>eHealth 1</td>
<td>.869</td>
<td></td>
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<tr>
<td>eHealth 2</td>
<td>.908</td>
<td></td>
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<tr>
<td>eHealth 3</td>
<td>.830</td>
<td></td>
</tr>
<tr>
<td>eHealth 4</td>
<td>.849</td>
<td></td>
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<tr>
<td></td>
<td>16.791</td>
<td>3.190</td>
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EHealth literacy analysis

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<table>
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<tbody>
<tr>
<td>BI1</td>
<td>.792</td>
<td></td>
</tr>
<tr>
<td>BI2</td>
<td>.815</td>
<td></td>
</tr>
<tr>
<td>BI3</td>
<td>.701</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12.925</td>
<td>2.456</td>
</tr>
</tbody>
</table>

Behavioral intention analysis

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 6 iterations.

A linear regression model was run to understand the relationship between dependent variable and the independent variable. The result of the regression has been shown in Table III. The regression analysis reported that intrinsic and extrinsic motivational variables impact the usage intention towards online healthcare. However, there was no relationship established between eHealth literacy and usage intention.

Table III: Regression analysis

<table>
<thead>
<tr>
<th>Constructs</th>
<th>R</th>
<th>R²</th>
<th>F-Value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic Motivation and Behavioral Intention (H¹)</td>
<td>0.497</td>
<td>0.247</td>
<td>76.172</td>
<td>0.000</td>
</tr>
<tr>
<td>Extrinsic Motivation and Behavioral Intention (H²)</td>
<td>0.574</td>
<td>0.330</td>
<td>116.572</td>
<td>0.000</td>
</tr>
<tr>
<td>E health literacy and Behavioral Intention (H³)</td>
<td>0.087</td>
<td>0.007</td>
<td>1.820</td>
<td>0.179</td>
</tr>
</tbody>
</table>

An R-square value of 0.247 indicates that intrinsic motivation contributes around 24% towards intention to use online healthcare by consumers. Similarly R-square value of .330 states that extrinsic motivation contributes around 33% towards consumers’ intention to use online healthcare. However, contribution of eHealth literacy was not found to be significant in behavioral intention to use online healthcare, since the p value is above the significant value i.e. 0.05. Hence hypothesis H¹ and H² were accepted and H³ was rejected.

Discussion and Conclusions

Discussion: This study is an attempt to modify the TAM and is probably one of the first known researches to observe the relationships between motivations, eHealth literacy and usage intention in the online healthcare context. The proposed model uses intrinsic and extrinsic motivational variables which claim to be crucial factors in impacting usage intention towards online healthcare. The results from this research reinforce the importance of understanding the impact of extrinsic and intrinsic motivation on consumers’ usage intentions.

Further to add to this, also there was no relationship found between eHealth literacy and usage intention. Gray and colleagues [16] conducted a study on Canadian adolescents who had access to internet and had used internet sometime or the other for health.[17] The researchers found that this age group, despite of using information technology frequently, experienced difficulties in engaging with online healthcare resources and understanding them, thus projecting a poor eHealth literacy skill. Norman [12] in their study on establishing relation between eHEALS and other variables in their study reported that there was no significant relationship found between overall use of information technology and eHealth literacy.

Theoretical Implication: At an academic level, this research provides interesting insights for exploring usage intention of consumers towards online healthcare. To comprehend the usage intention, this study proposes a different research model which is an amalgamation of two well-established theories that is, the Technology Acceptance Model (TAM) and Self Determination Theory (SDT). The data analysis validates the proposed model has significant explanatory power in predicting consumer usage intention towards online healthcare with a purpose to recommend. In addition, to this, by integrating extrinsic and intrinsic motivation to the TAM model, this model attempts understand the consumers’ attitude.
This classification would help researchers understand the relationship between consumer attitudes and behaviors in the online healthcare space to a deeper potency.

**Practical Implications**

This empirically supported study provides insight into the relationship among the various constructs and the consumers’ motivation towards usage intention of online healthcare. These dimensions of consumer motivation shall be of immense benefit to the healthcare marketers as these will assist them in formulating their marketing and advertising campaigns according to the dimension which need to be prioritized as per consumer preference. The aspects from extrinsic motivation will provide the healthcare organizations an understanding of the preferences of the consumers in relation to the online healthcare content and information availability. This can be used by the organizations to develop interactive content, such as websites or gamified tools, which can help develop a positive usage intention of the consumers towards the online healthcare resources. The eHealth Literacy Scale does not show a direct relationship with the usage intention towards online healthcare resources, nevertheless it can be put to use by the healthcare policy makers to access the eHealth literacy skill level of the population set and accordingly develop tools and resources for clinical care and population health.

**Limitations**

Like any other research, this study does come along with some limitations. Foremost, the results cannot be generalized to a larger sample size because the current study uses a small sample based on convenience sampling. The sample size is also geographically limited, thus presenting a scope for further research where the study can be carried out using classified customer profiles or varied human settlements, namely urban and rural.

**Conclusion**

The healthcare space has been receiving immense attention due to the upcoming innovations in the sector because of information technology. An integrated model by using constructs from TAM, SDT and eHEALS was proposed for this study. This model was empirically tested in the context of Bangalore. The findings indicated that consumers’ are using various online resources and search engines to find answers to their healthcare related queries. However the gap still remains in helping consumers’ identify reliable and authentic information sources from these online resources so that they can make informed decisions.

**Source of Funding:** Self funded

**Conflict of Interest:** Nil

**Ethical Clearance:** No ethical clearance was required for this study. This is a purely consumer usage intention study executed through an online survey.

**REFERENCES**


ABSTRACT

Background and Objectives: Pune district is known for endemic of vector borne diseases like malaria, dengue and chikungunya. Assessment of knowledge of preventive practices of rural community about vector borne diseases is important for designing community-based interventions.

Method: A community-based cross-sectional study was conducted among 100 adults selected by random sampling method in two villages of Pune district (village1, village2). Data was collected using pre-validated semi-structured questionnaire. Data was analyzed using SPSS version 20.

Results: Out of 100 samples 54% samples were taken from village1 whereas 46% samples were from Village2. 36% were male and 64 % were females. 80% were married while 20% were unmarried. Overall knowledge score of the sample was 36.5 (60.83%). 88% of the sample expressed that they do not have closed drainage system. Mosquito breeding sites found more in village2 (54%) than village1, which was statistically significant at p=0.01. Knowledge of practices about prevention of vector borne diseases was significantly associated with education status of the samples in both the villages. Potential breeding sites were significantly more in village2 (68%), Similarly actual breeding of mosquitoes was found significantly more in houses of village2 (n = 55, 55%), which was statistically significant (p = 0.01).

Conclusion: Creating awareness among rural population using diverse methods is required to control and prevent vector borne diseases.

Keywords: knowledge, preventive practices, rural community, vector borne diseases

Introduction

Vector-borne diseases had always remained as an important public health problem. Every Year there are more than one billion cases detected and over one million deaths occur from vector Borne diseases globally. Malaria causes the most number of deaths among the vector borne diseases. WHO estimated that there were 627,000 Deaths and 207 Million cases in 2012, Mainly in Sub Saharan Africa followed by South East Asia1. Morbidity due to malaria and dengue are very high in the recent years, Approximately 80% of India’s population lives in malaria risk areas. In Spite of mass communication and educational approaches, community participation is far below expectation. Community participation in turn depends upon People’s knowledge, awareness and attitude towards the disease. 2

Educational interventional programmes are cost effective to improve knowledge of vector ecology and disease epidemiology and prevention among the resource poor community.3

A study on Knowledge and Preventive Practices about Mosquito Borne Diseases in Delhi found that knowledge about mosquito borne diseases was significantly associated with education status of the participants.4

Several socioeconomic studies in various countries indicate variation in knowledge and practice related to
Vector-Borne diseases. Despite of so many efforts to control malaria, dengue and chikungunya, these diseases are still having a huge impact on health, wellbeing and economy of the people. Hence the key success for vector borne diseases control depends not only on services provided by health authority but also on knowledge on clinical manifestation, awareness and early care seeking behavior of the community. There is a need to know existing knowledge and practice regarding mosquito borne diseases and its control in community.

Community based health education interventions are effective tool in prevention and control of Vector Borne Diseases. It is observed that during outbreak of epidemic people and social activists insist on insecticide but scientifically it is not a sustainable measure to control VBDs. Personal Protective Measure (PPM) is one of the best control measure viz mosquito repellent creams, mosquito nets, coils etc.

Pune district is endemic for malaria, dengue and chikungunya. The temperature in the district ranges from 8.3°C in winter to 36.5°C during summer. The district is surrounded by hills and network of streams which provide breeding sites for vectors. People from rural area are ignorant about preventive practices. Understanding the preventive practices of the community regarding vector borne diseases is necessary for development of a suitable health education strategy and finally to determine the requirements of media type and specific channels for effective communication and efficient dissemination of information. Government of India under its National Vector Borne Diseases control Programme also emphasizes upon various control measures including health education to control the diseases and its spread.

Many research studies conducted in tropical countries on mosquito-borne-diseases, however vector borne diseases are concerned with climate change and global warming every part of the world is affected. Therefore this study was conducted to assess the knowledge of preventive practices regarding mosquito borne diseases and its prevention among resident of rural area to help design effective public health programme in prevention of this growing threat.

Materials and Method

A community-based cross-sectional study was conducted in two villages (Urwade and Mutha) in the study area (Mutha –PHC) of Pune district from Jan – March 2016. The study participants were adult male and female residing in both the villages. The sample size was 100 adults (50 from each village) selected by random sampling method (village1, village2). Baseline survey was carried out by house-to-house visit. Observations were made regarding socio-economic, environmental and cultural factors

Data was collected using pre-validated semi-structured questionnaire after taking written informed consent. Study was conducted during by interview technique. Total 60 items were included in the questionnaire. Questionnaire was prepared in regional language. Demographic data includes age, sex, income, education, type of house etc. Questionnaire consist of breeding sites, use of mosquito repellent, availability of mass-media in house, drainage system, methods of garbage disposal, use of latrines etc. Data was analyzed using SPSS version 20.

Results

Section 1: Description of subject is according to

Demographic Data: A total of 100 adult villagers participated in the study. There were 36% were male and 64 % were female respondents in the rural sample. All male and female respondents were adults. Out of 100 samples 54% samples were taken from village1 whereas 46% samples were from Village2. 80% were married while 20% were unmarried.

Out of 100 participants 91% perceived mosquitoes as a big problem in causing VBDs. Most of the people were affected due to water lodging during rains in both the villages. Breeding sites identified were small ponds, drainage water on roads, small shrubs around house. Most of the houses found unplanned with no proper drainage system. Overall knowledge score of the sample was 36.5 (60.83%). 88% of the sample expressed that they do not have closed drainage system. Mosquito breeding sites found more in village2 (54%) than village1, which was statistically significant at p=0.01. Knowledge of practices about prevention of vector borne diseases was significantly associated with education status of the samples in both the villages. Potential breeding sites were significantly more in village2 (68%), Similarly actual breeding of mosquitoes was found significantly more in houses of village2 (n = 55, 55%), which was statistically significant (p = 0.01).
Response for each question was recorded and analyzed. Researcher observed the availability of sources of knowledge. The result is shown in Table 1. It is noted that in village1 mass-media equipments are more than village2. Newspaper and Internet facility is negligible in both the villages. It interprets that peoples prefer using mobile phones than television. (Table 2)

Table 1: Overall Knowledge Score

<table>
<thead>
<tr>
<th></th>
<th>Mean Score</th>
<th>Percentage</th>
<th>Mean %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village 1</td>
<td>40</td>
<td>66.66</td>
<td>60.83</td>
</tr>
<tr>
<td>Village 2</td>
<td>33</td>
<td>55.00</td>
<td></td>
</tr>
</tbody>
</table>

During interview a question regarding habits and behaviors of participants with reference to prevention of VBDs was asked and their answer is tabulated in Table 3.

Table 2: Sources of Knowledge

<table>
<thead>
<tr>
<th>Type</th>
<th>Village1</th>
<th>Village2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
</tr>
<tr>
<td>Television</td>
<td>44</td>
<td>44%</td>
</tr>
<tr>
<td>Radio</td>
<td>11</td>
<td>11%</td>
</tr>
<tr>
<td>Newspaper</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td>Mobile phone</td>
<td>65</td>
<td>65%</td>
</tr>
<tr>
<td>Internet facility</td>
<td>9</td>
<td>9%</td>
</tr>
</tbody>
</table>

Table 3: Preventive Practices of Respondents

<table>
<thead>
<tr>
<th>Answer</th>
<th>Village 1</th>
<th>Village 2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency %</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Takes action regarding open drainage and stagnant water</td>
<td>54 54</td>
<td>51 51</td>
<td>0.00</td>
</tr>
<tr>
<td>Sleeping outside of the house in open air</td>
<td>45 45</td>
<td>41 41</td>
<td>0.00</td>
</tr>
<tr>
<td>Aware about all breeding places of vectors</td>
<td>44 44</td>
<td>43 43</td>
<td>0.1</td>
</tr>
<tr>
<td>Regular use of PPE followed</td>
<td>55 55</td>
<td>54 54</td>
<td>0.2</td>
</tr>
<tr>
<td>Follower of swach bharat Abhiyan</td>
<td>61 61</td>
<td>54 54</td>
<td>0.008</td>
</tr>
<tr>
<td>Uses safe latrines and insist family members too</td>
<td>76 76</td>
<td>66 66</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Mean Knowledge score of the participants: The people from 61 and above years have more knowledge i.e. 65.33% followed by age group between 36-60 year have 63.44% age group between 25-35 year have 60.25% followed by age group up to 25 year have 58.53%. The gender of the sample taken for the main study in that the male have more knowledge i.e. 63.79% compare to female i.e. 60.20% The education of the sample taken for the main study in that the class 11-12 people have more knowledge i.e. 39.44% followed by people up to 7th std have 37.17% followed by people 13 & above have 37% followed by people 8-10th std have 36.15% followed by illiterate 58.14%. The occupation of the sample taken for the main study in that skilled people have more knowledge i.e.68.61% followed by unskilled people have 36.78% followed by housewife have 36.7% followed by student are 34.9%. The married people are more knowledgeable 62.33% as compare to unmarried i.e.58.16%.

Table 4: Responses on where mosquito breeds

<table>
<thead>
<tr>
<th>Responses</th>
<th>Village 1</th>
<th>Village 2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency %</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Drains</td>
<td>28</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Stagnant water</td>
<td>15</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Garbage Store Places</td>
<td>21</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Green Plants (small in height)</td>
<td>32</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Cattle shed</td>
<td>11</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>In the house with no ventilation</td>
<td>13</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Dark and moist places</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Places of water storage</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Very deep mud vessels when water level at the bottom</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Discussion

The study was conducted in the rural area of Pune district. The study conducted is very significant to plan educational intervention for rural community to prevent Vector Borne Diseases. Two villages were selected where Vector Borne Diseases prevalence was high. The majority of the samples were female and their occupation was housewife, the level of education among majority of the samples was less than 10th standard. Overall knowledge of preventive practices among the study population was 60.83%. A similar study was conducted by Tobgay et al in which they found poor knowledge of participants in regards to knowledge of malaria control practices in rural of Bhutan. A similar study by Arpit et al indicates that overall knowledge of link workers found was 15.7%.  

The study samples were not found using personal protective methods to protect from mosquito bites, the reason may be low literacy rate and low socio-economic background. Similar study was conducted in District Ranchi which was World Bank Supported malaria control programme which recommends stratified approach of indoor space spraying. Another low cost method of control of VBD is the water management in high prevalence area.

In the interview of the participants it was observed that none of the respondent was aware of indoor breeding places of mosquitoes. Further participants were unaware of day time biting of the mosquitoes. This is alarming knowledge level among respondents. Television and mobile phones are main source of knowledge among rural population. These media should be exploited in bringing change among rural population. Similar study was conducted in rural area of Thailand by Phuanukoonnnon et al and found indoor water vessels were infected by larvae.

Interpretation and Conclusion

The study reveals that the demographic variables like gender, education and income found to have significant association with the knowledge and practice of rural population regarding vector borne diseases and its prevention. It is important to not only to understand diseases cycle but also to reduce number of cases in the population. It is significant therefore effective health awareness program help to educate population about local health threats. Long term prevention and control strategy should be adopted for rural population. Public health-care accessibility and top down approach of administration should be increased in marginalized area of the country.

Acknowledgements

The researcher is grateful to participants of the study, field workers who have helped in collection of the data, PHC staff and sub-centre staff of Urwade and Mutha village for their great support. Researcher further acknowledges the contributions of other local community peoples and who have assisted directly and indirectly in completion of this study.

Source of Funding: Nil

Conflict of Interest: None declared

Ethical Clearance: Taken from Institutional Research Committee

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Assessing the Quality and Safety of Home Healthcare Services provided by Tertiary Care Hospital

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ABSTRACT

Introduction: The present study is based on Home Healthcare service provided by Tertiary Care Hospitals in Mumbai. These tertiary care hospitals provide services like Nursing Care, Physiotherapy Care, Home Sample Collection and providing the reports and X-ray at patient’s home environment.

Objectives: To determine the quality and safety of the Home Healthcare services.

Novelty/Originality: Limited studies have been conducted as home healthcare is emerging field.

Materials & Method: The questionnaires were prepared by taking under consideration the JCI guidelines for Home Healthcare Patient Safety 2016 for all the four services viz. Nursing Care, Physiotherapy Care, Home Sample Collection and X-ray. The patient’s data was collected for the period of five months through telephonic medium which was further compiled and analysed.

Results & Discussion: The study revealed satisfaction percentage which were above 95% for nursing care and home x-ray services, physiotherapy and home sample collection need improvement where percentage was between 80% to 90%. Further gap analysis was done where mean score of service dimensions like reliability, responsiveness, assurance and empathy were calculated. The highest gap observed for empathy dimension (0.24) followed by responsiveness (0.15) and assurance (0.12).

Application: Results from such studies will help improve the service delivery.

Conclusion: It is an emerging field hence, this research will help the hospitals in understanding the gaps in home healthcare services, which will in turn enhance the quality and safety of health care services at patient’s home environment.

Keywords: Home Healthcare Service, Quality, Safety, Gaps.

Introduction

It was a common practice of caring for someone medically at home before modern medicine era set in. Hospitalization was rare phenomenon. People believed in traditional way of giving treatment and comfort to the ailing person. Today, with a growing trend toward reduced hospital stays, home healthcare is gaining in popularity. While caregivers of the past were generally family members or friends, home healthcare today usually consists of a professional healthcare team working toward a common goal [1]. Home healthcare is defined by the National Clinical Homecare Association (2011) as “the provision of medical supplies and/or clinical services directly to patients in the community [2].

Home healthcare services aims at helping individuals to improve health and live with greater independence. It aids in promoting the client’s optimal level of well-being; and assist the patient to remain at home, avoiding hospitalization or admission to long-
term care institutions. Consultants may refer patients for home health care services, or family members or patients themselves may request the services [3][4]. Home health care is a system of care provided by skilled practitioners to patients in their homes under the direction of a physician. Home health care services include nursing care; physical, occupational, and speech-language therapy; and medical social services[5].

The home healthcare market is expected to reach USD 349.8 Billion by 2020 from USD 227.5 Billion in 2015, growing at a CAGR of 9.0% from 2015 to 2020. Major factors driving the growth of this market include rising aging population, increasing incidences of chronic diseases, growing demand for affordable healthcare delivery systems due to the increasing healthcare costs, technological advancements, and government initiatives to promote home healthcare [6]. Health care is a big concern in India, the land of nearly 1.12 billion people4 and the second most populous country in the world. It is estimated that lifestyle diseases will account for a whopping 74% of total deaths by 2030 (compared with 56% in 2008) with Cardiovascular, Cancer and Diabetes accounting for a majority. Home-based healthcare is an initiative to reach to such households beyond the boundaries of traditional hospital infrastructure [6]. With growing geriatric population, where India stands second, it is essential that such services are promptly promoted and utilized. Home Healthcare is a need of the today’s world. With increase in number of chronic diseases and increase in need of convenience, the Home Healthcare sector is emerging day by day. In such services, it is very important to maintain and quality and safety of the service as home healthcare services are provided at patient’s home, which is completely different from hospital setting[7].

Thus, a study was planned by the tertiary care hospitals, to find out satisfaction among the patients who have received such care services in the comfortable environment of home and also to find out the gaps and suggest recommendation to reduce the same.

Various aspects of quality and safety were studied; these aspects include appointment booking procedure, punctuality of the home health staff, behavior of home healthcare staff towards patient and reporting facility. In addition to this patient’s safety aspect such as asking for doctor’s prescription before doing any procedure, educating the patients regarding the procedure carried out, taking the blood sample in one prick were also taken under consideration.

Methodology

This cross-sectional study done for the home healthcare services provided by the tertiary care hospital in the city of Mumbai. Data was obtained from the patient who had availed these services in the year 2016. The study period was for five months, i.e. from January to May 2016.

For the purpose of data collection, four types of services were chosen namely:
- Home Nursing Care
- For Home Physiotherapy
- For Home X-ray Service
- For the Home sample, collection

Sample Size Obtained:
- Home Nursing Care: 144
- Home Physiotherapy Care: 11
- Home X-Ray Service: 24
- Home Sample Collection Service: 459

Thus, the total patients surveyed were- 638

The feedback was taken from the patients using the patient satisfaction questionnaire prepared for each of the four departments under home healthcare of tertiary hospital about their satisfaction level with respect to:
- Appointment booking procedure.
- Patient Identification
- Punctuality
- Patient safety precautions

Results and Discussions

1. Home Nursing Care: Nursing care provided by hospital is for routine and specialized care. The nurse attendants re well-qualified registered nurses, who are on roll of employment with the hospital. The nursing staff is also trained in basic life support by American heart Association making them well qualified and equipped for the job. This as seen in the percentage of satisfaction in table 1, which is above 95% in all parameters. Patient safety is of utmost importance in home healthcare services. Criteria like asking for
doctor’s prescription before the procedure, educating the patient regarding the procedure and making patient comfortable during the procedure were taken under consideration, which scored high in terms of satisfaction.

### Table 1: Satisfaction Percentage on parameters related to home healthcare services

<table>
<thead>
<tr>
<th>Services</th>
<th>Parameters- Satisfaction Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Appointment booking procedure</td>
</tr>
<tr>
<td>Home Nursing Care (n = 144)</td>
<td>98.5%</td>
</tr>
<tr>
<td>Home Physiotherapy Care (n = 11)</td>
<td>100%</td>
</tr>
<tr>
<td>Home X-Ray Service (n = 24)</td>
<td>94.4%</td>
</tr>
<tr>
<td>Home Sample Collection Service (n = 459)</td>
<td>94.10%</td>
</tr>
<tr>
<td></td>
<td>Patient Identification</td>
</tr>
<tr>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>94.7%</td>
<td></td>
</tr>
<tr>
<td>98.55%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Punctuality &amp; Reporting</td>
</tr>
<tr>
<td></td>
<td>97%</td>
</tr>
<tr>
<td>90.9%</td>
<td></td>
</tr>
<tr>
<td>97.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Patient safety precautions</td>
</tr>
<tr>
<td></td>
<td>95.5%</td>
</tr>
<tr>
<td>94.9%</td>
<td></td>
</tr>
<tr>
<td>95.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. **Home Physiotherapy Care:** The physiotherapy care provided is mainly for orthopedic patients and post-operative cases. The aim is to help patient regain strength, movement and function. The physiotherapist are also well qualified with bachelors of physiotherapy and adequate experience. Usually electrotherapy like Ultrasound, IFT, TENS along with manual therapy like mobilization and soft tissue techniques like Myofascial release and Trigger point therapy is carried out for patients with periodic re-evaluation and follow up. The no. of patients availing the service is gradually going up. With respect to patient safety. However, measures needs to be taken for patient identification where satisfaction percentage is 81% other parameters score high as compared to this one. It is important to ask patient/family members regarding the medication history of the patient before giving the physiotherapy treatment, risk assessment of the patient’s home environment and make patient comfortable during the physiotherapy treatment. Here the percentage is 94.9% as depicted in tale 1, which can be worked on where ample care should be taken to follow all the procedures and protocols before administering the treatment along with punctuality and reporting.

3. **Home X-Ray Service:** This service is mainly targeted for senior citizens who find it difficult to come to hospitals for getting their X-ray done. Thus, a team of medical assistants is sent along with portable X-ray machine to provide simplified and stress free experience. With appointment procedure, 94.4% patients were satisfied. For patient safety aspects such as confirmation of name and prescription of the patient, not allowing family members inside the house during X-Ray procedure and taking X-Ray in one attempt etc. re included to which 95.8% patients were satisfied as per table 1. As this facility is brought to the comfort of the home, people have to pay little above the regular price, thus making this aspect where 84.3% are satisfied with the cost of X-Ray.

4. **Home Sample Collection Service:** This is the widely used service of the hospital, for which they have employed trained technicians who are good communicators as well. As per table 1, 94.10% are satisfied with appointment procedure, rest they feel it takes little longer for them to take appointment when they call. It is also suggested that there should be on line system for ease of taking appointment. With punctuality of phlebotomist, staff 94.7% patients are satisfied. Patient Identification scores 98.55% for satisfaction. Patient Safety which include 3 aspects such as washing hands before procedure, wearing gloves, and taking sample in single prick, this aspect has 86.6% satisfied which needs improvement tremendously as it may lead to certain hazards which can be harmful for patients and end up earning bad reputation for the hospital.

Moreover, with more competitors operating in the market. It becomes even more imperative to take care of these parameters for sustaining the patient base.
Table 2: Gap Analysis between Patient Expectation and perception of care providers of various Service Dimensions

<table>
<thead>
<tr>
<th>Service Dimensions</th>
<th>Mean Score (Customer Satisfaction)</th>
<th>Mean Score (Perception of care providers)</th>
<th>Gap between customer expectation and employee perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>3.77</td>
<td>3.99</td>
<td>-0.23</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>4.03</td>
<td>3.99</td>
<td>0.15</td>
</tr>
<tr>
<td>Assurance</td>
<td>3.89</td>
<td>3.775</td>
<td>0.12</td>
</tr>
<tr>
<td>Empathy</td>
<td>3.99</td>
<td>3.8</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Table 2 shows the gap analysis between patient expectation & employee perception of various service dimensions. The highest gap is observed for empathy dimension (0.24) followed by responsiveness (0.15) and assurance (0.12). Positive gaps indicate where hospital should focus more and should make improvement on above dimensions of services so that gaps can be filled. In case of reliability (-0.23) is negative which shows customers are satisfied with what services are offered by the hospital to them.

**Conclusion**

Home Healthcare service is majorly provided to the patients who are in need of convenience or for patients who find difficulty in travelling all the way to the hospital for availing medical services.

The Home Healthcare service is a one of the best option for the patients because they have the trust of getting quality care from this hospital. It was revealed from the study that certain parameters score above 90% in satisfaction where as there are only few parameters where attention and focus needs to be given in order to enhance patient experience. It is important for the home healthcare service to provider to maintain the quality and safety of the services because the care is given outside the hospital setting. Hence, the home healthcare staff should follow a proper protocol so that the patient feel satisfied after receiving the services, a continuous improvement-training program is also necessary. There is a great need to increase the patient base hence proper implementation of strategies should be done to reach out to large number of patients. Home healthcare service is a necessity of today’s world because of increasing geriatric population and chronic diseases with acute shortage of hospital beds, patients want alternative sources. Hence, Home Healthcare is the best option to consider catering to the healthcare needs of the population.

**Recommendations**

**For quality improvement**

- A proper protocol should be maintained so that uniform care is provided to all the patients.
- Home healthcare staff can be given refreshment training on patient safety protocol.
- Regular monitoring of most common systemic diseases like Diabetes, hypertension and thyroid problems.
- Phlebotomist should be certified and diploma holder with proper training.
- An Online Appointment Booking can be started to ease the appointment booking procedure and reduce the time required for booking the appointment on Call.
- Psychological counseling of geriatric patients should be done on regular basis by healthcare staff.
- Report Facility of sample collection service needs lot of attention. A system can be developed where a patient can track his/her report or patient can be informed via SMS or Call about the report when it is ready for delivery.
- A confirmation from patients can also be taken after the report is delivered to them.
- Training can be given to the staff regarding identifying the patient correctly using Name, Address or Contact Number.
- The patient’s and test information barcodes can be stuck on the sample as soon as sample is collected from the patient as this will reduce the risk of misplacing sample or performance of wrong test and can give assurance to patient that the sample is labelled correctly.
As per the patients’ feedback, the cost of X-Ray service is expensive, hence it needs to be revised and competitive pricing can be done.

Online Mode of payment can be introduce for home healthcare services offered.

Each call has to be recorded by the Home Healthcare department to know exact calls being converted into successful appointment.

To reach out to more number of patients:

Need to track the discharged patients from the IPD and patient need to be informed about the home healthcare service of the hospital.

The Advertisements films can be shown on the television in the OPD/Visitors lounge areas.

The Live Chat can be introduced on the website to clarify the doubts of the patient visiting the website, as this can also help to reach more number of patients.

Need to prepare more informative website portal for Home Healthcare Service of the Hospital.

Source of Funding: Nil

Conflict of Interest: Nil

Ethical Clearance: IEC of Symbiosis International (Deemed University)

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Awareness of Virtual Reality in Surgical Training in India

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ABSTRACT

The traditional surgical training has constantly changed as it is recurrently resisted by concerns of patient safety, the cost of operating room and complications all over the world. Virtual reality training allows a surgeon to achieve skills in less time before operating on any patient. The development of technology, hardware has significantly improved patient’s safety, increased surgical skills and produced expert surgeons. It has been proven in western countries that virtual reality is effective solution for improving surgical skills, but the awareness and use of such kind of surgical skill training is questionable in Indian Scenario. The research explores understanding of surgical training, its awareness and current status in India. Expert & Novice surgeons from different surgical departments were interviewed about the process of surgical training and awareness of virtual reality in India. The data collected was interpreted through qualitative method. The technology will automatize for the betterment of patient safety and surgeons practice. The purpose of the study is to create awareness of the virtual reality in Indian Surgical training institutes. The approaches of constant innovation and ongoing progress from the experience retrieved from virtual reality training from different fields might provide the strong substructure for next generation to reduce errors in surgical training. Virtual reality in surgical training has progressed technologically to ensure the good quality of life worldwide.

Keywords: Virtual reality, Surgical training in India, Patient Safety.

Introduction

Surgical edification and its training is an important aspect of Indian Health Care System. A traditional way of teaching this surgery was observing the operation procedure done by senior or experienced doctors and then to perform the same process on a patient. The traditional way has to confront a lot of errors made by novice surgeons. Many times surgery became fatal due to complications that occurred during surgery. It has been argued, if quarantined, technical skills are insufficient for successful surgery practice. Such complications have raised an issue of legality and ethics for patient safety. The ancient root of virtual reality the three-dimensional computer-generated world in which a person can move and interact, is already well defined for recreating the virtual world as real world to improve the surgical skills. The operating room is constantly changing its environment due to advancement in visualization, monitoring and instrumentation. This change in complex environment has an impact on the execution of the surgical procedure. This research paper identifies the awareness of virtual reality in surgical education in India. The study provides an insight about the current education in the field of surgery, different strategies of surgeons to cope up with new technologies and current application of virtual reality in surgical training.

Literature Review

The era of virtual reality was in existence since the 18th century. Virtual reality is a three-dimensional computer-generated world in which a person can move and interact as if he is actually in the imaginary place. The first attempt in virtual- reality training was done in laparoscopic surgery by computer simulations by American Society for Gastrointestinal Endoscopy. Then computer-based simulation, found to be new attractive way of teaching as early laparoscopic training was challenging for teachers and for students to accept the handling and control of laparoscope. Main limitations of the computer model were real images cannot be stored in the computer and hence additional hardware was required for storage so it can be retrieved easily. The advancement after the computer simulation was to have tactile feedback. Sometimes cadaveric tissues were put in the box for some procedures, to boost realistic experience. These box trainers had a low...
fidelity[5,6]. Simulators are replaced by invention of the tablet made surgical training inexpensive yet effective. Students and surgeons can now practice at their own pace. Now-a-days, the robotic-assisted surgery is the promising invention. Where patient and surgeons share the operating room but surgeon operated on a patient with the help of robotic devices[7]. The robotic-assisted surgery provides the three-dimensional vision and easy suture capability without tremor though it’s slightly costly and is time-consuming for assembling it[8]. While many people contributed in improving the technology, few were working on its application. An experiment was done to compare the value of virtual training & real world training, it proved the transfer of real world training was more beneficial than other two. It confirmed that the virtual reality for transfer of training needs to be improved[9]. Anthony Gallagher[10] Hansoon[11] Alhering[12] & Grantcharov[13] proved that participant who went through the virtual training acquired the skills faster[10], number of errors in operation and time utilized for one particular operation was significantly reduced[11] and Virtual reality successfully transferred surgical and psychomotor skills using a robotic interface[12,13].

Material and Method

In this study, it is important to know the surgical education in India, opinion of surgeons on virtual reality. The participants selected for semi-structured interview method were a homogenous group of surgeons. The interview was planned for 30 minutes but due to time constrains the questions were cut down in pilot study. The participant selection was done through snowball method of sampling. Most of the surgeons had face to face interviews. Surgeons outside Pune were approached, prior consent was taken by email and interview was recorded on mobile phone. The participants were identified irrespective of their age, gender, experience and specialty. Out of 20 identified surgeons, 13 agreed to participate in the interview and 7 surgeons’ dropped out due to their unavailability. Amongst 13 surgeons, 10 were male participants and 3 were female participant. Out of the 13 participants, 4 were practicing surgeons and 9 were professors in teaching institutes. The experience of the surgeons participated was from 10-39 Years giving perception of both novice and experienced surgeons. The Participants were selected irrespective of their specialty. All the Participants were given former explanation about the study. It was also clearly mentioned that the interview would be recorded. Participants were asked to sign the consent form prior to the interview. The interviews were manifested in semi-structured way. Interviews were conducted with possible themes of surgical education in India, coping with constantly changing technologies and how is virtual reality helpful. Interviews were recorded and transcribed. The interviews were analyzed as per grounded theory approach. This theory generates the material from semi-structured material, where the categories are constantly compared and redefined[14].

Result

Current surgical education in India: 23% of participants were classified as “explained the procedure in short”. Hence phrases such as observing; strict supervision “See and do method” were coded as “Surgical education- Short Explanation” confirming to principles of grounded theory[14]. 46% were classified as “surgical education as per global standards”. They also mentioned different methods to inculcate in surgical education such as Cadaveric courses; Fellowships; Clinical and theoretical exposure; research in teaching. 31% of participants talked about the change in surgical education within the decade & were classified as “Changes –Surgical education”. Participants mentioned students have access to 3D images, animations, and students have gained confidence due to technology.

Current Surgical Education

Coping with new technologies: Many participants (62%) were segregated as “Academic Conferences & Seminars” as they believed that attending conferences will update the knowledge. Phrases such as “international conferences”, “National conferences”, “International Seminars”, “National Seminar” “Continuing Medical Education (CMEs)” were included. These phrases were coded as “Conferences” explained that the participant believed that such kind of conferences, seminars
or CMEs would update the knowledge, keep them up to date with knowledge and technologies. These participants also believed that such kind of training would help students to accommodate new knowledge and practice it in person. Some participants (23%) were segregates as “Speakers” as they mentioned that calling experts from fields updates the knowledge. Phrases such as “Guest lectures”, “workshops”, “Guest Speakers” and “Spokesperson” were included in this category. These phrases were coded as “Guest Lectures” explained that the participants update their knowledge by inviting international and national speakers and sharing knowledge with students in the same lecture. It helps as the students and the participants are in close contact with the speaker and have one to one conversations.

Few participants (15%) were segregates as “Academic Research” as they mentioned that doing research enriches the students as well as the participant’s knowledge. Phrases such as “Research work”, “Experimental studies”, and “case studies” were a part of this group. These phrases were coded as “Research”. It also shows them different ways of doing a particular surgery to reduce errors and increase the efficiency.

Coping with New Technologies

How is virtual reality helpful for students? It was seen that as the experience of surgeons were minimum 10 years. Everybody was aware of virtual reality and it uses. Participant’s view on the use of virtual reality and its applications in India was interesting. Many participants (54%) were classified as “easily able to relate” as they used one of the following phrases to the open ended question. Do you feel virtual reality would be helpful for students? Phrases such as “virtual models”, “demonstration rooms”, “virtual classrooms”, “students gets idea of relevant anatomy” “Laparoscopic simulators”, “robotic surgeries”, “Simulators”. Such phrases were coded as “Virtual Reality is helpful”. Many participant agreed that the use of virtual reality would help a novice surgeon to practice on the simulators first and then on patient. They also believed that not only novice surgeons but also the expert surgeons can practice complex cases to reduce the cognitive overload. One of the participant mentioned that “All the novice surgeons are exposed to Virtual lectures in their institutions and now. We (hospital & teaching institution) have developed simulation lab recently, so we are excited to see students having first hand learning experience”. One of the participants quoted “few of my students are practicing robotic surgeries in Pune and Mumbai”. Few participants (15%) were classified as “Difficult to accept the concept” as they used one of the following phrase such as “its only knowledge”, “use of information is questionable”, “every surgery increases situation awareness”, “feel of tissues in virtual model is altered”. Such phrases were coded as “Virtual reality is not helpful”. One participant compared context of western country and in India. “Through virtual reality one can gain only knowledge, how a novice surgeon would use that knowledge is questionable. Three participants (31%) out of 13 participants were classified as “Acceptance with uncertainty” as they used one of these phrases such as “VR is costly”, “Socioeconomic status of our country”, “financially unviable”. Such phrases were coded as “Virtual reality is costly. One mentioned- “These are costly so we try to have virtual lecture series for our students”. Another participant said “the socioeconomic position that our country is uniquely placed in, doesn’t allow us to use the virtual reality in practical way”. One more participant quoted “Virtual reality in the form of dissection and 3D model are available as cross-section of MRI is not financially feasible for all the institutions to buy these machines. Institutions and hospitals who can afford it are buying it”.

Discussion

In India Undergraduate and postgraduate level of medical education is derived from British medical education system [16]. Currently, 8765 seats are provided in several recognized colleges offering Postgraduate
courses in Surgery \[17\]. The program suggested by Dr. William Halsted has been unchanged within the residency training program \[16, 18\]. The residents are always under strict observation to share the knowledge, present research work, stay updates in the field \[19\]. The automation of technology serves betterment of patient safety and surgeons practice. The first steps were taken by Richard M Satava\[2\] aiming surgical residents will have a new perspective of surgical anatomy and will sharpen their surgical skills before they perform surgery on a patient\[2\]. It has been proven in western countries that virtual reality is effective solution for improving surgical skills. Few researchers compared the value of virtual training, real world training, and no training and found that the transfer of real world training was more beneficial \[9\]. Similarly, few surgeons compared the context of western world and Indian scenario on the biases of number of patients. He said:“Numbers of patients in western countries are less and hence they need such equipment’s to master any surgery. Whereas here in India we have lot of patients hence a surgeon is exposed to variety of cases of same diseases or different diseases”. While another surgeon compared an experience of feel and tissue tension between cadaveric dissection and virtual reality. Though the technology is changing constantly- such as haptic feedback, three-dimensional images, audio feedback, audio-visual interface to enhance the whole experience, surgeons still doubt the precision and user experience of the virtual world \[20\]. In the year 2004, Grantcharov\[13\] with his team examined the influence of simulation training on psychomotor skills on the performance of laparoscopic cholecystectomy and found that surgeons who received VR training showed greater improvement in performance in the operating room. It was also observed that time taken to complete the procedure and error score was reduced \[13\]. Few surgeons agreed that virtual reality is helps in reducing the surgery time and increase the decision making of the novice as well as expert surgeons. These participants were uncertain on the cost and maintenance of the simulators and virtual reality lab. Many institutes and the hospitals have engaged the finance into developing the simulation lab or virtual reality lab. As increase in awareness, the hospitals which can afford the new technology are already equipped with robotic surgery setups. Surgeries such as Radical prostatectomy; joint replacements are performed with robotic surgery.

**Conclusion**

Surgeons are aware about virtual reality and accept that virtual reality training plays a significant role in surgical education. On one side the institutes are developing the simulation labs, on the other side while practicing surgeons are already equipped with robotic surgery techniques. Within few coming years, this innovative tool will be a part of surgical curriculum.

**Conflict of Interest:** No conflict of Interest.

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**Ethical Clearence:** Taken from Institutional Research committee.

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Study on Public Awareness of mHealth Apps Introduced by the Government of India

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ABSTRACT

Introduction: The world, including India, is realizing the potential of a smartphone for healthcare delivery. In light of this promising use of technology, the Indian government launched mHealth applications in 2016 under National Health Portal. However, there is no evidence or effort to track the awareness and usage of these applications by the public. This study aimed to gather the level of awareness and usage among the population for the same.

Material and Method: 6 health apps under ‘National Health Portal’ of India were considered. A self-administered questionnaire was prepared and sent to respondents over email. Their responses were recorded and analysed.

Results: Out of 119 responses, 51.27% were aware of any of the six considered apps. Out of those who were aware, a meagre 4.91% have used any of these apps. Majority of the respondents have used health app by a private firm.

Conclusion: The population studied was not alien to the concept of health apps. Majority of them have used an app but from a private firm and not the one launched by the government. With the growth of telecom sector, excellence of Indian IT industry, booming investment in healthcare industry, increasing technological literacy of the population, and above all, acceptance among population of using mobile applications as way of managing one’s healthcare, the government of India should take more efforts in creating awareness and encouraging the citizens to make use of these apps.

Keywords: mHealth, mobile applications, Government of India, digital health

Introduction

Healthcare throughout the world has been growing more rapidly than ever before. The integration of technology is not only reducing morbidity and mortality, but also bringing healthcare to people’s homes. mHealth (mobile health) especially is proving to be crucial for this purpose. mHealth involves the use and capitalization on a mobile phone’s core utility of voice and short messaging service (SMS) as well as more complex functionalities and applications including general packet radio service (GPRS), third and fourth generation mobile telecommunications (3G and 4G systems), global positioning system (GPS), and Bluetooth technology. The concept of mHealth in India is not new. It is being heavily boosted by the tremendous growth in the telecom market. Between 2017 and 2022, the number of smartphone users in India will grow over 60% to reach 490.9 million. The monthly data usage per smartphone in India is expected to increase from 3.9GB in 2017 to 18GB by 2023.

Out of all the uses of mHealth, the use of applications is being explored tremendously all over the world. A mobile application, most commonly referred to as an app, is a type of application software designed to run on a mobile device, such as a smartphone or tablet computer. Mobile applications frequently serve to provide users with similar services to those accessed on PCs. In India too, through the platform provided by companies like Android and Apple, the population is exposed to numerous health apps. These
apps offer services in various areas such as fitness, diet, doctor appointment, doctor consultation, doctor reviews, medicine home delivery, meditation, medicine reminder, pill identifier, skincare, hair care, period tracker etc. All these apps are majorly owned by the private sector of either Indian origin or foreign.

The Ministry of Health & Family Welfare, GoI, set up ‘National Health Portal’ in 2015, under the Digital India initiative, with a vision to make this as a single point access for authenticated health information for citizens, students, healthcare professionals and researchers.4

Numerous health apps were launched through this portal, using Android and Apple app stores as a platform, and addressing varied health issues. This study focuses on 6 of those apps.

1. Directory Services: Contains a database of hospitals and blood banks across India. It accesses the user location and enables a person to find nearby hospital and blood bank.

2. Swasth Bharat: Empowers citizens to find reliable and relevant healthcare information.

3. Indradhanush: Facilitates young parents in tracking the immunization of their children.

4. Pradhan Mantri Surakshit Matritva Abhiyan: Aims to provide assured and quality antenatal care, free of cost, universally to all pregnant women on the 9th day of every month. It facilitates the engagement of private/voluntary sector.

5. Mera Aspataal: Captures patient feedback for the services received at the hospital.

6. NACO AIDS: Provides information on HIV AIDS and related services including risk evaluator, service center locator, myths & facts, toll free helpline etc.

Rationale: These apps address a lot of major healthcare issues of the country. Besides the immense market potential, use of these apps for healthcare delivery is extremely cost-effective.5

It is also a faster means of communication with real-time update and user interaction. It empowers the users to take decisions and saves their time and increases compliance. In a resource-constraint country like India, this potential, if used appropriately, may prove to be a trump card.6

However, three years since their launch, there is hardly any effort towards its monitoring and evaluation. There are no updates regarding its awareness generation, use and outcome.

Objective

The objective of this study is to estimate the awareness & usage of the mHealth applications among public introduced by the Government of India in 2016.
Material and Method

- **Study:** A cross-sectional descriptive type of study was done.

- **Sampling design:**
  - **Population:** Individuals of urban area currently using a smartphone
  - **Sample size:** 119 respondents
  - **Sampling method:** Convenience method
  - **Study duration:** 20 days
  - **Data source:** Primary and Secondary source
  - **Sampling technique:** Non-probability purposive type of sampling

- **Tool used for data collection:** A self-administered questionnaire was prepared. Both quantitative and qualitative type of responses were recorded.

- **Tools used for data analysis:** Microsoft Excel was used for analysis and results have been represented graphically.

Results

Out of 119 responses recorded, 51.27% were aware of any of the six considered apps and 32.77% knew more than one app. Out of those who were aware, 4.91% have used any of the apps.

![Figure 2](image)

However, it wasn’t that the respondents didn’t know any mHealth apps at all. 56.3% were aware of some mHealth app on Android or Apple Stores. Out of these, 65.67% have used a health app. As high as 70.5% of these users were satisfied with the performance of the app and even recommended it to others.

![Figure 3](image)
Among those respondents with medical or allied background, 47.62% were aware of the apps, out of which 15% have used any of them.

Interestingly, out those who have used a health app, 56.81% were aware of the health apps launched by the GoI.

It was also observed that when asked to name a health app they knew, 51.35% of the apps named were Indian in origin, with Practo topping the chart. All of them are owned by private firms. Majority of them catered to the areas of fitness, consultation with healthcare professionals, medicine sale and appointment booking.

The respondents relied on two major sources for seeking healthcare related information which are consultation with a healthcare professional (48.7%) and Google (37.8%).

Indian healthcare industry is expanding immensely with swelling investments. Private equity and venture capital funding in healthcare sector has gone up by 13 times, from US$ 94 million in 2011 to US$1,275 in 2016. Digital intervention in healthcare is expected to drive the industry at a CAGR of 23% by 2020. The public health expenditure in India too has increased from 1.12 trillion Rupees in 2014 to 1.58 trillion Rupees in 2018.

Globally the healthcare is seeing more and more technology being integrated in it. Having a digital front door will ensure sustainability. This is concurred by Deloitte in one of its studies in 2018. It said that the future of work is going to be powered by technological advancements and an augmented manpower which combines people and machines to get things done.

Launching mHealth apps at such a time has been a crucial and necessary way forward by the government of India. However it is struggling to sensitise the population towards this platform. The conversion rate of being aware to being a user is unsatisfactory and distressing. The number of app downloads itself speak for themselves. The government apps are struggling in thousands while the private apps are rejoicing in millions.

It is to be noted that a lion’s share of respondents are of the age group 18-30 years who are quite adept at using a smartphone. More than half of the respondents have rated themselves above average for the same. This fact is reiterated in the respondents’ choice of using the internet to seek health information. Especially to book appointments and order medication for home delivery.
This is reflected in the most popular apps among the respondents, where Portea, 1mg and DocsApp are offering the said services. This eliminates any doubts regarding technological illiteracy posing as a barrier.

Coming to the other end of the spectrum, the National Health Portal launched these apps in the latter half of 2016. It has roughly been a little over 2 years and is still in its nascent stage. Majority of other private apps mentioned in this paper are roughly a decade old. Hence more time should be given to the government to streamline this resource and start utilising it to its complete potential.

In addition, the government is still in the process of making a strong law regarding data privacy and protection. Last year the Ministry of Health & Family Welfare released the draft of Digital Information Security in Healthcare Act (DISHA).\(^\text{11}\) It was the first legislative attempt of the country towards privacy of those seeking medical assistance. With big data now being considered as the strength of a country, the government will be cautious with all such initiatives.

Another important factor is the fierce competition. There were about 3,25,000 health apps on Android alone in 2017.\(^\text{12}\) This competition is growing each day with newer companies and tech giants showing interest in the unexplored healthcare industry.

**Conclusion**

The healthcare industry in India is full of paradoxes. Hence such a disruptive solution of launching mHealth apps is indeed a need of the hour and can prove to be revolutionary for the country. It is cost-effective (for both patient and provider), provides real-time feedback and can improve the efficiency of existing resources. The environment too is complementary to flourish this system of healthcare delivery: the growth of telecom sector, excellence of Indian IT industry, booming investment in healthcare industry, increasing technological literacy of the population, and above all, the acceptance among population of using mobile applications as way of managing one’s healthcare.

However efforts should be made to make the population aware and generate more and more users of these health apps. Introducing services will prove to be advantageous only if they are availed by the population. In addition, better monitoring and evaluation needs to be done. Amalgamation of technology with healthcare is the way forward and a promise of a better future. The time is ripe to leverage this and turn it to India’s biggest advantage.

**Source of Funding:** Self

**Conflict of Interest:** Nil

**Ethical Clearance:** This study did not involve any intervention or experiment and caused no harm to the participants. Hence ethical clearance was not necessary.

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Role of CSR Expenditure in Health Care—A Comparative Study of Select Market Cap Ranked Indian Companies

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ABSTRACT

Introduction: With the enforcement of CSR Act 2013 by Government of India, the corporate sector has been mandated to spend 2% of their average net profit for the last three years on community development related activities. Indian companies have been actively spending the CSR budget on various areas which includes health and sanitation. It has been observed that major emphasis in terms of CSR is on their own areas of interest. The paper aims to investigate the pattern of CSR budget spend in the health and sanitation areas by top 300 stock market listed Indian companies in the context of the UN Sustainable Development Goals.

Method and Materials: For the study the data was collected from the annual reports available on the company websites for the financial years 2015, 2016, 2017 and 2018 as also from online financial platforms like Bloomberg.

Results: The preliminary findings of the data suggest that most of the pharma and health care companies CSR spend is focused on health and related areas.

Keywords: CSR, Health Care, SDG, Pharmaceutical industry.

Introduction

Economic growth resulted due to the rapid strides by the human being over the last two hundred years has led to the economies across the globe to expand from the agrarian base to the industrialised economy. Significant economic progress to millions of people through better living standards, access to energy, communications, transport, health care, education etc, post the industrial revolution also had remarkable impacts on the developmental economy viz –a vis social inequities and environmental impacts¹. Three important sectors namely industrialization, socio cultural values and the environment have perhaps been one of the most tumultuous phases in the development of man in the context of development.

In the 1900s most of the developed group of nations moved ahead rapidly, through rapid industrial growth to create a welfare system linked to a corporate social responsibility oriented approach and can be termed as a land mark decade in the history of mankind. It was also one of the decades when the entire issue of sustainability as a tool of corporate business practice became a reality with the involvement of major industry players, civil society, academic bodies, and the United Nations.

While philanthropic activities always existed for decades, CSR disclosure practices began to be demonstrated only in the 1990s². The decades of 1990s and 2000s are perhaps seen as a turning point not only in India’s economic growth curve but also heralded a change in global understanding of business growth through increased market based investment, corporate social responsibility led initiatives and regulatory frameworks.

Background

The philanthropic dimensions of social responsibility has been well demonstrated amongst the Indian corporate sector ³⁴. With the enforcement of CSR Act 2013 ⁵ by
Government of India, the corporate sector has been mandated to spend 2% of their average net profit for the last three years on community development related activities under Section 135 of the Act. Since the advent of this act, Indian companies have been actively spending the CSR budget on various thematic areas including health and sanitation, the reasons for companies investing in spending are driven by moral and ethical dimensions or from a strategic perspective to provide community support across social fabric of society. Some authors suggest that increased expenditure in CSR coupled with social transformation efforts can help companies gain competitive advantage in a market driven globalised economy. In Indian context CSR spends amongst the corporate world are driven by a variety of factors including moral values integration by the top management, regulatory process and perhaps in recent times more strategic as per the report of PWC, 2013.

Western models of CSR have influenced the Indian CSR initiatives eventually causing a receptive reaction of an impromptu nature. Stakeholders like employees, customers, suppliers and others influence the CSR initiatives of the corporates. In light of societal desires for partners, associations ought to create and improve their CSR programs and mirror these advancements to their notoriety mechanisms.

Indian companies rely on measurable and accountable measures of CSR and multinational companies usually follow their host country initiatives. The government has a major role to play in developing CSR as a top-down strategy; the businesses commonly use CSR initiatives as a planned tool to improve their image. A normative issue may arise with respect to the monitoring process, as businesses are more likely to have a closer relationship with NGOs, thus increasing the potential risks of regulatory capture or co-optation. The driving factors for corporate social responsibility movement are to create vital advantages of hierarchical qualities of an association which define its capacity to produce upper hand from the reception of a worldwide CSR structure.

A study of 416 Spanish firms displays the subjective and objective motivators and de motivators based on a multifactorial framework, analyzing their joint effect on the final degree of sustainability. In Indian context, a study of 200 small and medium enterprises in the two states of West Bengal and Odisha involving manufacturing and services, shows that environmentally responsible practices and the associated concept of corporate social responsibility are still to take root at the level of Indian SME. In all CSR themes, disclosures are primarily narrative rather than quantitative or monetary.

A recent report by CRISIL (2019) highlights the fact that nearly Rs 50,000 crores have been spent cumulatively in the past four to five years. Increasing focus on business responsibility reporting as mandated by SEBI is also driving market listed companies to focus more on CSR budgets. e.g. in FY 2018 nearly Rs 10,000 crores alone was spent on CSR by listed companies. Education and skill development, health care and sanitation, rural development constitute the majority of CSR spending by the businesses irrespective of their sector of operation. The paper aims to investigate the pattern of CSR budget spend in the health and sanitation areas using the top 300 stock market listed Indian companies in the context of the UN Sustainable Development Goals.

**Method and Materials**

Current research on CSR related aspects within the health sector or other aspects has been limited to social reporting disclosure through a legitimisation approach with comparison between MNCs and Indian companies listed company analysis using Triple bottom line approach, CSR expenditure. The results give out imperative observations for the management heads of CSR activities and by and large administration of the organizations.

The present research has been conducted on the top 300 market listed companies on their CSR activities from the point of view of governance and from the dimension of stakeholder’s responsibility on the governance of CSR. The study also seeks to compare CSR spending amongst health care related business as a part of the market listed companies. For the purpose of data collection, information on budgetary expenditure, CSR budgets was collected from the annual reports available on the company websites for the financial years 2014, 2015, 2016, 2017 and 2018 as also from online financial platforms like Bloomberg.

The key objectives of the study included:

1. To explore the pattern of CSR spend by the top 300 stock market listed companies in various areas
2. To analyse the pattern of CSR spend by health care business related companies in the area of health and sanitation.

3. To compare and analyse CSR expenditure of health care business and non-health care business with area of spend.

Results

Data of the top 300 listed companies as per the market cap was collected from various authentic sources such as Annual reports of the companies available on their official websites. The data compilation was carried out in order to understand the pattern of CSR budget, CSR spend with reference to CSR budget for the financial years 2013 till 2018. The preliminary analysis of the data has been depicted in Fig. 1 which summarizes the pattern of the CSR spend with reference to the total CSR budget. From the introduction and implementation of the CSR Act in 2013 it can be observed that there has been increase in the total CSR budget and accordingly an increase in the CSR spending.

The shift from the voluntary activities to mandatory involvement of CSR helps in successful endeavor for upliftment of society. Involvement of the organizations in the CSR activities has been very positive and the community has been benefited by the activities directed towards key areas but needs a strategic and focused approach. As per the CSR policy guidelines the organizations can utilize the CSR funds in the areas classified broadly in the act which includes education, environment, health care and sanitation. In the Indian context it has been a practice to use the CSR funds in the areas which would help community and the business directed towards sustainable development. Across various sectors, organizations choose activities of their interest and spend the CSR budget in those activities. With an objective for maximization of wealth and community development, businesses have inclination towards community development and economic development of the nation and hence education being the most preferred area for CSR spending. It has been found that in the last three financial years, education has been the most preferred area followed by health care and sanitation for all the companies for spending their CSR budget as per the India CSR outlook Report 2018. Education programs help in strengthening young generation and hence would bring in sustained results through the involvement and investment of the business organisations through their CSR programs both in rural and urban India. Equally important area which needs focus through the CSR activities has been health and sanitation as healthy population of the nation has been more important than any other aspect of life. Current scenario in Indian context has poor health care system for public and it requires involvement and investment not just from the government but also from corporates. Responsibility of corporates has become indispensable to provide healthcare through activities related to health care benefitting the community at large.

It has been observed from the data analysis of the top 300 companies CSR budget spending pattern that the spend on the health care and sanitation related projects which has been in the range of 20–25% of the total budget utilized and has been depicted by Figure 1.

![Graph showing CSR funds utilization in health care and sanitation](image)

![Graph showing CSR budget vs CSR spend for the top 300 listed market cap companies](image)

Figure 1: Comparison of CSR Budget and CSR Spend & CSR Funds utilized in Health care and Sanitation (2013-18)
Some examples of the major business organizations CSR projects such as ONGC and Indian Oil Corporation focus on higher education, adoption of 56 villages by BHEL & Indian Airlines, Infosys’s computer and language education, health care, culture and rural development, Tribal development program by IBM, Environment conservation, health and medical care, education, women upliftment programs by SAIL, GlaxoSmithKline focus on health and healthy living through projects involving medical check-up and treatment, health awareness programs, health camps etc 23. Data analysis of the organizations under study representing various sectors and their CSR funds utilization in health care and sanitation related activities was carried out and figure 2-6 represents sectorwise comparative analysis for the financial years 2013 to 18.

Figure 2: Sector wise Spend in health care and sanitation FY 2013-14

Figure 3: Sector wise Spend in health care and sanitation FY 2014-15
Figure 4: Sectorwise Spend in health care and sanitation FY 2015-16

Figure 5: Sectorwise Spend in health care and sanitation FY 2016-17

Figure 6: Sectorwise Spend in health care and sanitation FY 2017-18
Figure 2-6 indicate the percentage contribution of CSR budget utilization by various sectors in the areas of health care and sanitation projects. It can be observed that Oil and Gas and BFSI sector have been the major contributors with their contribution for the year 2013-14 as 15.40 and 30.80 respectively where as the contribution of the pharma and health care sector combined has been around 4%.

The products, strategies and the activities of the companies in the pharma sector be it a company dealing in generic medicines or special drugs have always been of interest to the media and public. These companies CSR activities focus mainly on activities such as health awareness campaigns, medical checkup camps, sanitation service providers and many more. From the data analysis it has been observed that pharma sectors contribution in the health care and related projects has been rising from the year 2013-14 till 2017-18, from 11.08% to 50% whereas the spend by the non-pharmas sector companies has been in the range of 25-30%. The rise in the % spend by the pharma sector companies under study indicates that their CSR activities have been more focused and directed towards health care and related areas.

Discussion

Evolution of CSR in India from philanthropic to mandatory due to CSR Act, 2013 has provisions for the organisations to carry out these activities themselves or partner with NGO’s and report it in their annual reports. In context of this the paper the CSR budget, CSR fund utilization for the top 300 market listed companies was discussed and explored the pattern of CSR spend by these companies in various areas. Analysis of the data also aimed at understanding the pattern of CSR spend by health care business related companies in the area of health and sanitation and compared the CSR expenditure of health care business and non-health care business. From the results it has been observed that the major emphasis of pharmaceutical companies has been spending the CSR budget in the health care and allied areas and also have seen rise in their contribution year on year in health care related projects.

Conclusion

The paper discussed the CSR spend patterns followed by pharma and non-pharma companies and provides recommendations on how non-pharma also can spend CSR funds in health care and sanitation such as Ayushman Bharat aiming at providing healthcare facilities covering urban and rural poor. The study also brought out the fact that the sanctioned CSR budget does not gets utilized which can be pulled together and directed towards Ayushman Bharat project initiative either individually or collectively in association with the major private health care facilitators, diagnostics centers, hospitals etc. This would bring in many stakeholders such as Government, Private organizations. NGO’s and educational institutions together and help build a healthy generation.

Ethical Clearance: Not required

Source of Funding: Self

Conflict of Interest: Nil.

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Introduction: Anemia is still one of the major public health problems in India; most common nutritional deficiency in pregnant women is identified Iron deficiency anemia (IDA) in various studies over the time. Anemia is condition in which the number of red blood cells is insufficient to meet physiologic needs, which vary by distinguish socio-demographic factors, economic factors and pregnancy status including number of pregnancies and children ever born. Iron deficiency is emerged out as one of the most common cause of anemia globally.
in the levels of anemia among women \[2\]. The National Anemia Prevention and control guidelines have been developed taking cognizance of the current scientific evidence. The National Iron+ Initiative guidelines have been developed by the Adolescent Division of the Ministry of Health and Family Welfare (MoHFW), Government of India. Prevention and control of anemia is one of the key strategies of the Health, Nutrition and Population Sector Programmes for reducing maternal, neonatal and childhood mortality and improving maternal, adolescent and childhood health status.

Malnutrition worldwide includes a spectrum of nutrient-related disorders, deficiencies, and conditions such as intrauterine growth retardation, protein–energy malnutrition, iodine deficiency disorders, vitamin A deficiency, and iron-deficiency anemia \[3\].

Anemia is defined as decreased hemoglobin level, or circulating red blood cells and it is the most common hematological disorder during pregnancy. Pregnant women with hemoglobin level less than 11g/dl should be considered as anemic\[4\].

Many study were conducted in India and abroad identified, various socio-demographic factors such as age, educational status, socio-economic status, type of work, dietary habits, parity were associated with the prevalence of anemia during pregnancy. Anemia is easily diagnosable, treatable and totally preventable disease. Thus to limit the prevalence and reduce the complications caused by anemia, common determinants has to be identified.

**Objectives**

The specific objectives of the study are to

1. Find out the association between socioeconomic and demographic factors with anemia among women in EAG states of India
2. Investigate the determinants of anemia among women in EAG states of India

**Material and Method**

In this study secondary data was used. More specifically, fourth round of national family health survey (NFHS, 2015-16) data was considered to fulfill the objectives of the study. Appropriate statistical techniques were applied to identify the significant socio-demographic and economic determinates of anemia among women in EAG states of India namely multivariable logistic regression. In India, the eight states with poor indicators pertaining to social, economic, demographic and health are considered as EAG states. These states include Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan, Orissa, Uttarakhand, Jharkhand and Chhattisgarh. NFHS – 4 data were analyzed after fetching the data from these states. The variables of the study are briefly described below.

**Dependent variable:** Anemia level: Women with any anemia (mild, moderate, severe) are considered as any type of anemia. For multivariable logistic regression, anemia is divided into two categories, which are any anemic=1 or not anemic=0.

**Independent Variables:** The study includes a set of independent variables to understand the extent and differentials of anemia among women and its effect on the outcomes. The study divides variables into two categories, namely as socio economic and demographic characteristics/variables. The variables are described below:

The characteristics of women include: Place of residence: (rural and urban), caste: (scheduled caste/ tribes, other backward caste, General), Women education level: (Illiterate, 1-5 years, 6-10 years, 11-12 years and >= 13 years), Marital Status: (Currently Married and Formerly Married), Type of family planning use: (not using, CP, IUD, female sterilization, others) Body mass index: (underweight, normal weight, overweight, obese), Employment: (not working, non-manual, agricultural and Manual), Mother Parity: (zero, first, second, third, fourth and fifth & above), Diet: (non –vegetarian and vegetarian).

**Results and Discussion**

The fourth round of the national family health survey data was analyzed to accomplish the objectives of study. The prevalence of anemia was analyzed for India and its EAG states. In India 53 % women found reported with any kind of anemia. In EAG states, anemia level amongst females found reported as; Madhya Pradesh and Chhattisgarh (52.5% & 47.0%), Bihar and Jharkhand (63% & 65%), Uttar Pradesh and Uttarakhand (52.4% & 45.2%), Rajasthan (46.8%) and Odisha (51%) respectively. Analysis further suggests that females residing in rural areas of the EAG states, illiterate females, Scheduled Tribes females, underweight females, females with higher parity and females working in agriculture sector found having more anemic than their counterparts in almost all the EAG states.
Table 1: Shows the analysis of adjusted multivariable logistic regression model through miscellaneous predictor’s variable of reproductive age group (15-49) women of EAG states

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* represents 5% level of significant, **represents 10% level of significance, OR is odds ratio. CH = Chhattisgarh, JH = Jharkhand and UK = Uttaranchal.
Table 1, shows finding of adjusted logistic regression using different predictor variables for anemia across the EAG states of India. Across the EAG states, the anemia level determined by their different socioeconomic and demographic determinants; those women belonged to rural areas were 45% and 15% more likely to suffer from anemia than those women who were not anemic and residing in urban, particularly in Jharkhand and Rajasthan, respectively. The causes for these changing patterns, and inform the policy and programmatic response to address anemia and its inequalities in the vulnerable population [5]. Body mass index was identified across the EAG states as important determinant for anemia [8]. Underweight women were more likely to anemic than its counterparts.

Conclusion

Among the EAG states, anemia found associated with several factors among women like rural residence, parity, diet, schedule tribe, educational status and body mass index (BMI). Anemia continues to be a problem with the existing health care resources. Body mass index (BMI), literacy of women and mothers’ parity emerged out as the major determinants that contributed to the problem of anemia across the EAG states. Therefore, public health education/information on reproductive health, body mass index (BMI), monitoring the compliance of women with ante-natal care services, and strengthening of their health care seeking behavior are important health care measures to be carried out at the community level. Also, it is high time for realization that health system should focus on various factors that contribute to the occurrence of anemia and include them as an important indicators in the national health care policy.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: The unit level data from NFHS-4 is available in the public domain (IIPS, ORC Macro, 2018). The survey was approved by the International Institute for Population Studies (IIPS), ethical review board in India. A standard consent form approved by the Ethics Review Committee was read-out to the respondents in their native language.

REFERENCES


A Literature Review of Measurement of Health Literacy in India

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¹Medical Officer–Research (Community Events), Symbiosis Community Outreach Programme and Extension (SCOPE), Symbiosis International (Deemed University); ²Professor & HoD, Community Health, Symbiosis College of Nursing (SCON), Symbiosis International (Deemed University)

ABSTRACT

Introduction: WHO defined Health Literacy (HL) as ‘the cognitive and social skills which determine the motivation and ability of individuals to gain access to understand and use information in ways which promote and maintain good health’. There is lack of related research in Low and Middle Income Countries.

Objective: The study was undertaken to investigate health related aspects and tools used to measure HL in Indian population.

Novelty/Originality: On the background of paucity of research, this review is unique in its kind and depicts latest scenario.

Materials and Method: Studies mentioning measurement of HL and published from 2014 to 2019 were searched in SCOPUS, PubMed and Google Scholar databases. After excluding those not meeting inclusion criteria; findings of 26 studies were analysed.

Results and Discussion: Pre-validated HL scales were used in 9 studies; 88.9% of which measured only reading and pronunciation ability related to medical terms. In other 17 studies; self-designed questionnaires were used which were developed from past literature and questionnaires predominantly measuring technical knowledge and disease-related practices of participants. 90% of studies measured HL related to specific medical conditions; 81.4% of which comprised of dental, mental and diabetes disorders. 88% of total studies were cross-sectional in nature and 38.5% were undertaken on patients and their caregivers. Though different types of aspects were measured, low levels of HL were observed.

Application: The findings will be useful to design action plan for development of conceptual clarity amongst researchers.

Conclusion: The research on HL in India is still confined to basic skills of reading and pronunciation and related knowledge and practices. Limited use of pre-validated HL measurement scales was evident. There is a need to undertake research representing all populations and scales suitable to Indian context.

Keywords: Health literacy, India, Measurement, Scale

Introduction

Health Literacy (HL) is defined in variety of ways by different researchers across the world. It was described by WHO in 1998 as ‘Health Literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health’.¹ It is also defined as ‘the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions’.² Mentioning to low and middle income countries (LMIC), WHO recently described it as ‘the personal characteristics and social resources needed for individuals and communities to access, understand, appraise and use information and services to make decisions about health’.³ The term ‘HL’ is related to the general literacy which is in itself a broader concept than ability to read, write and understand. Education for All Global monitoring report by UNESCO studied various definitions and concepts of literacy around the world and put them into four broad categories; ‘as an autonomous set of skills’, ‘as applied, practised and situated’, ‘as a
learning process’ and ‘as text’. Low levels of literacy has been associated with lower health outcomes in past literature. Interestingly, low levels of HL also are found to be associated with undesirable health outcomes as well as inadequate use of health services. Application of appropriate HL interventions can be effective to improve health status of populations. Measurement of HL is a point of concern now-a-days as there are many scales available but no scale is considered to be accurate. Larger amount of research on concepts and measurement of HL has been undertaken in developed countries as compared to LMIC or developing countries. As there are lack of conceptual clarity about HL and lack of pre-validated scales for developing countries like India; it is important to understand the scenario of research work being conducted on Indian population in recent years. So, this study was undertaken to study the scenario of HL research conducted on Indian population in last 5 years. This systematic review was conducted with the objectives as follows: a) What is the percentage of use of pre-validated HL measurement scales? b) What types of aspects were studied for measurement of HL?

Materials and Method

PubMed, Scopus and Google Scholar were systematically searched to identify relevant articles published from January 2014 to December 2019. Considering time and resource constraints, the article search in Google Scholar was restricted to the condition that title should be having the term ‘Health Literacy’. One researcher conducted article search between 4 February 2019 to 10 February 2019 using key words ‘Health Literacy’, ‘India’ and combination of these words. The details of process of literature search are given in Figure no. 1.

Inclusion criteria: For a study to be included it had to 1) be published from Jan 2014 to Dec 2018, 2) be conducted on Indian population and 3) the study should have been conducted measurement of Health literacy.

Exclusion criteria: Studies measuring health literacy as part of validation or development of a scale were excluded.

Based on these criteria, total 26 studies were selected for the final analysis.8-33

Results

Demographic characteristics of study participants: Adult age group was included by largest number of studies (80.8%) as participants followed by elderly population (42.3%) and adolescents (34.6%). Urban population was studied in 21 (80.8%) studies while rural and semi-urban populations were studied in 11 and 2 studies respectively. The study participants were enrolled from different groups of society. Largest numbers of studies (10, 38.5%) were undertaken on ‘patients and their caregivers’, followed by ‘students and teachers’ (9, 34.6%). Rest of the studies were conducted on general population (3, 11.5%), parents (3, 11.5%) and women (2, 7.7%).

Characteristics of HL tools used in studies: Pre-validated HL scale was used in 9 (34.6%) studies; half of which included tests investigating reading and pronunciation ability of participants {8 (88.9%)}.

Table 1: Types of pre-validated HL measurement scales and their subversions used

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of pre-validated scale on HL</th>
<th>No. of times used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rapid Estimate of Adult Literacy in Medicine/Dentistry Scales</td>
<td></td>
</tr>
<tr>
<td>1.a</td>
<td>REALD-30</td>
<td>3</td>
</tr>
<tr>
<td>1.b</td>
<td>REALM-66</td>
<td>2</td>
</tr>
<tr>
<td>1.c</td>
<td>REALD-99</td>
<td>2</td>
</tr>
<tr>
<td>1.d</td>
<td>REALMD-20</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1: Types of pre-validated HL measurement scales and their subversions used
Conted…

<table>
<thead>
<tr>
<th></th>
<th>Study of Functional Health Literacy in Adults (S-TOFHLA)</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>HL in Dentistry (HeLD)</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

17 studies did not use pre-validated scales. They used self-designed questionnaires based on previous literature to find out various aspects of HL. However, more than half of the studies (58.5%) did not checked reliability or validity of the questionnaire before use. 27 out of 30 studies measured HL pertaining to a specific disease/health condition. Highest proportion of studies investigated oral health (36.7%) followed by diabetes and mental health. Other health conditions studied include nutrition, hypertension, tuberculosis, anaemia, medicine dosage and those not specified to any particular disease. The details are given in figure No. 2.

**Type of health conditions studied**

<table>
<thead>
<tr>
<th>Health Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>38%</td>
</tr>
<tr>
<td>Other diseases</td>
<td>28%</td>
</tr>
<tr>
<td>Mental</td>
<td>17%</td>
</tr>
<tr>
<td>Not related to any disease</td>
<td>17%</td>
</tr>
</tbody>
</table>

**Figure 2: Type of health conditions studied**

Aspects studied for measurement of HL: As there is no exact definition or conformity in the concept of HL; variety of aspects are been studied across the world while measuring HL. It was investigated that which such aspects were measured by the researchers in this study. List of all aspects was made and then is grouped into broad categories based on previous literature. Majority of domains identified were ‘to understand health related information’ (15%), ‘knowledge of various aspects of the disease’ (13.8%), ‘practices followed about prevention, treatment and care of the disease’ (13.8%), ‘attitude towards the disease’ (11.3%), and ‘ability to read and pronounce health-related terms’ (11.3%). The details of various domains identified are given in Figure No. 3.

**Level of HL:** Mixed results were obtained about level of HL in participants, but larger no. of studies showed lower levels of HL in participants.

**Discussion**

Systematic reviews on measurement of HL are scarce for Indian population. Thus, this study is one of its kind describing scenarios of HL measurement in India. The lack of availability of advanced HL measurement tools was mentioned in a systematic review done by Altin et al., where it was found that HL measurement tools are still predominantly cover functional HL level i.e. related with reading and pronouncing skills and knowledge and practice at personal level. These results support findings of our studies where majority of scales used were related to reading and pronunciation skills. Pre-validation of a self-designed instrument to check reliability and validity before use is one of the necessary process to ensure quality of the collected data. However in our study, only 41% of studies checked reliability and/ or validity of the self-designed instrument. These results are similar with a systematic review of diabetes literacy studies. Low levels of HL is associated with lower levels of education. Similar results were found in our study that irrespective of study settings, low levels of HL was found to be associated with lower educational levels of participants. Nutbeam described HL as a composite term and considered it as an outcome of health education. He proposed three levels of HL as functional, interactive and critical of HL. First level describes acquiring knowledge at individual level, acquiring skills at individual level and skills to influence society through knowledge sharing and action respectively. The findings of this study suggest that research in India is still restricted at first i.e. functional level of HL. This
study has few limitations such as this study included only those articles who mentioned word ‘HL’ in their titles. So, there could be more articles which have measured HL but haven’t mentioned the word in titles which are skipped. Additionally few articles use the word ‘Literacy’ in conjunction with a disease condition e.g. ‘Diabetes Literacy’; instead of using the word ‘HL’. Such articles could not be included in this study. The criteria of time period about publication were of only 5 years. These could reflect the scenario for very short period. As the study area of the articles included in this study was variable and not pan-national; the results of these studies cannot be representative of whole nation.

**Conclusion**

The study was conducted predominantly in urban adult population. Pre-validated scales were used in only one third of the studies. Versions of ‘Rapid Estimate of Adult Literacy in Medicine/Dentistry Scales’ were used mostly which measured ability to read and pronounce medical terms. The studies using self-designed questionnaires were confined to measure technical knowledge, practices, attitudes towards diseases and ability to understand health-related information. There is gap in the literature about studying broader aspects of Health Literacy which constitute higher set of skills and practices to utilize information. There is need to develop pre-validated HL measurement scales suitable for Indian population. Also, there is need to undertake studies covering larger populations and bring uniformity in measurement.

**Conflict of Interest:** Nil

**Source of Funding:** No funding was required and utilized for this study.

**Ethical Clearance:** The ethical clearance was obtained from IRC.

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A Comparative Electromyographical Analysis of Biceps Brachii and Brachioradialis During Eight Different Types of Biceps Curl

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ABSTRACT

Introduction: Biceps curl is one of the most traditional and highly popular weight training exercise that target the muscles of the upper arm (Biceps Brachii muscle). There are many variations of this exercise that can be used to design a training schedule for the best result.

Objective: This study aimed at analyzing the muscle activation of Biceps Brachii and Brachioradialis muscles while performing different biceps curl exercises with the same load.

Novelty: To the best of our knowledge none of the studies has analyzed the muscle activation of Biceps Brachii and Brachioradialis muscles with the selected exercises.

Material and Method: Ten healthy subjects (20.8 ± 1.75 years) performed 70% of 1 repetition maximum (RM) for eight different biceps curl exercises. Surface ElectroMyoGraphy (SEMG) was used to measure muscle electrical activity that occurs during muscular contraction.

Results and Discussions: The results of the study shows that, in case of muscles activation in Biceps Brachii, except supine narrow grip Z curl (SNGZC) and prone lying biceps curl (PLBC), all the other exercises reveal significant differences with the concentrated curl (CC). No statistical difference was observed when comparing the muscle activation of Brachioradialis muscle in the eight different biceps curl exercises.

Application: It will help the professional trainers and coaches to design training schedule for all level of Athletes which may consist of different variations of the biceps exercises.

Conclusion: Concentrated curl is a more effective exercise for activation of biceps muscles as compared to other exercises with the same load. All the selected biceps exercises have the same effect on activating the Brachioradialis Muscles.

Keywords: Electromyography, Muscle activation, Biceps curl, Biceps Brachii and Brachioradialis

Introduction

Biceps curl is one of the most traditional and highly popular weight training exercises that target the muscles of the upper arm (Biceps Brachii muscle). For most of the men who all are into fitness, big arms enhance their personality and boost confidence because of which they keep on measuring the circumference of their biceps muscle on a regular basis. Now – a – days there are lots of variations of this exercise that can be used to design a training schedule for the best result. The variation that significantly increases the activation of the biceps muscle with the same load can help the athlete, coaches and trainers to plan the schedule accordingly. The correct utilization of muscles in an economical fashion helps improve activity and prevents the risk of injury. It will not only help for selecting correct exercise to train the
biceps brachii muscles of an athlete or general population but it will also play a vital role for rehabilitation of upper arm muscles for an injured athlete. The changes in the activation of different muscles depend upon the shape and density of the muscles. In this very respect of the physiological responses, the electromyographic measurements gain great importance [3].

The generic use of Electromyography (EMG) is to detect the neuromuscular abnormalities. In modern human performance laboratories, electromyography is one of the common but essential equipment that is used by sports performance coaches, sports scientist and sports medicine professionals [3]. Electromyography utilizes either surface electrodes that are placed over the muscle or needle electrodes placed into the muscle. Surface ElectroMyoGraphy (SEMG) is a protrusive technique for measuring muscle electrical activity that occurs during muscle contraction and relaxation cycle. EMG uses electrodes to detect signals and translate these signals to graph or numeric values, which can be interpreted by the professionals. As the subject then moves the joint and contracts the muscles, the EMG unit detects the action potentials of the muscles and provides an electronic readout of the contraction intensity and duration. EMG is the most accurate way of detecting the presence and extent of muscle activity [4].

Resistance exercise is a specialized method of conditioning, involving progressive use of resistance to increase one’s ability to exert or resist force [5]. The specific exercise performed is based on the action of a target muscle group. This is often motion specific in athletes. Even athletes and coaches are continually looking for new methods that will be helpful in improving power and strength. To the best of the researcher’s knowledge, none of the studies has analyzed the muscle activation of Biceps Brachii and Brachioradialis muscles with the selected resistance exercises.

The purpose of the study was to investigate the effects of 8 different biceps curl exercises on the electromyographic (EMG) activity of Biceps Brachii and Brachioradialis muscles.

Material and Method

Subjects: Ten healthy individuals who were experienced at performing all the eight biceps curl exercises, averaging 20.8 ± 1.75 years of age, participated in this study. More specifically, each participant met our stringent requirement of at least 1 year of experience in all the selected exercises. The average height and mass of the subjects were 1.75 ± 0.10 m and 72.5 ± 6.0 kg, respectively. All subjects were free from injuries which would have limited their ability to perform the eight biceps curl exercises described below. Purposive sampling technique was used for the selection of the subjects. Before participation, informed consent was obtained from each subject.

Experimental Approach to the Problem: To compare the EMG response between different biceps curl techniques, subjects performed 1 repetition of 8 different biceps curl exercise, with surface electrodes positioned over the 2 muscle bellies (Biceps Brachii and Brachioradialis). A familiarization session was carried out 1 week before testing for knowing 1 RM of the participants. The 8 different biceps curl exercises were supine grip biceps curl (SGBC), supine narrow grip biceps curl (SNGBC), supine wider grip biceps curl (SWGBC), supine grip Z curl (SGZC), supine narrow grip Z curl (SNGZC), supine wider grip Z curl (SWGZC), concentrated curl (CC) and prone lying biceps curl (PLBC). The Surface ElectroMyoGraphy (SEMG) signal generated by the muscle fibres was captured by the electrodes, then amplified and filtered by the sensor before being converted to a digital signal by the encoder. It was then sent to the computer to be processed, displayed and recorded by the Infiniti software. The MyoScan-Pro sensor’s active range is from 20 to 500 Hz. It can record SEMG signals of up to 2500 microvolts (μV), RMS. A/D Converter (Encoder; ProComp Infiniti) has 2 channels (C and D) sampling at 256 samples per second.

One Repetition Maximum (1 RM): The maximal dynamic force in the biceps curl (BC) exercise was measured by the 1 RM test by using a straight bar (2 kg) and plate weights (0.5 kg, 1 kg, 4 kg, 5 kg, and 10 kg). Warm-up prior to the 1 RM test consisted of 30 to 60 seconds of the BC exercise and stretching of the upper limb musculature. The subjects were positioned in a standing position, holding a straight bar, keeping the forearms in a supine position. The initial load was 30 kg. The elbow flexion ROM (from 10° elbow flexion [0° = full extension], until approximately 110°) was to be performed completely [6]. The weight was incrementally increased until a 1 RM was established. EMG data was not collected on the first day of testing while the
1 RM was being established. Each biceps curl protocol consisted of performing one repetition with a load equivalent to 70% of 1-RM. This load was fixed for all the 8 different biceps curl exercises. It was done to see the muscles activation difference in 8 different biceps curl exercises with the same load (70% of 1-RM).

**Data Collection**

The participants performed 1 repetition of eight exercises one by one. Sufficient recovery time was given to the participants after completing each exercise.

On the testing day, maximum muscle activation was recorded with the help of Biograph infinity version 5.0 (Electromyography Software). After shaving and applying the abrasive cream to the electrodes, the EMG electrodes were placed parallel to the muscle fibre at two locations (i.e. channel C for Brachioradialis and channel D for Biceps Brachii). Raw EMG signals were recorded using a 15-foot optic fibre wire that was directly connected to A/C encoder. A twenty-megapixel extended video camera was synchronized with the EMG software (Biograph infinity version 5.0), to find out the maximum voluntary contractions (MVCs) of the selected muscles at the time of performing the exercises. Myoscan-pro sensor with triode electrode was used.

**Statistics**

The descriptive statistics (mean, standard deviation, skewness, kurtosis etc.) histograms, normal probability plots, and Shapiro–Wilk’s test was used for testing the assumption of normality and to know the nature of data. All data were presented as mean with standard deviations. A repeated measure analysis of variance (ANOVA) was used to detect the mean differences between each eight different biceps curl exercises. For this purpose Statistical Package for Social Science (SPSS) version, 20.0 was used. The level of significance was set at 0.05.

**Results and Discussion**

Descriptive Statistics along with test of normality was used to summarize the basic features of the data set. The skewness and kurtosis values were found to be less than twice the value of their standard error, hence the data for all the variables were symmetrically distributed [7]. Further for testing the normality Shapiro – Wilks test was used. It compares the scores in the sample to a normally distributed set of scores with the same mean and standard deviation. If the test is non – significant (p>.05) it tells that the distribution of the sample is not significantly different from a normal distribution (i.e. it is probably normal) and vice – versa. Here from the table – 1 we can see that none of the variables p-value was less than .05, hence the data was normally distributed.

| Table 1: Descriptive Statistics and Test of Normality |
|-----------------|---------|-------|-------|---------|---------|---------|---------|---------|
|                 | Mean    | Std. Error of Mean | Std. Deviation | Skewness | Std. Error of Skewness | Kurtosis | Std. Error of Kurtosis | Shapiro – Wilks (p-value) |
| Supine Grip Biceps Curl | Biceps  | 1546.4 | 76.2  | 241.04 | -0.961 | 0.687 | -0.351 | 1.334 | 0.09 |
|                     | Brachio-radialis | 1113.6 | 67.33 | 212.92 | 0.573 | 0.687 | -1.432 | 1.334 | 0.076 |
| Supine Narrow Grip Biceps Curl | Biceps  | 1535.4 | 82.78 | 261.79 | 0.415 | 0.687 | -0.353 | 1.334 | 0.788 |
|                     | Brachio-radialis | 1119.4 | 73.547| 232.57 | 0.202 | 0.687 | -1.894 | 1.334 | 0.106 |
| Supine Wider Grip Biceps Curl | Biceps  | 1708.6 | 145.06| 458.72 | 0.446 | 0.687 | -0.496 | 1.334 | 0.19 |
|                     | Brachio-radialis | 1139.7 | 46.42 | 146.8 | -0.862 | 0.687 | 1.491 | 1.334 | 0.701 |
| Supine Grip Z Curl | Biceps  | 1722.4 | 93.01 | 294.15 | 1.015 | 0.687 | -0.024 | 1.334 | 0.061 |
|                     | Brachio-radialis | 1249.4 | 99.706| 315.29 | -0.79 | 0.687 | -0.852 | 1.334 | 0.079 |
| Supine Narrow Grip Z Curl | Biceps  | 1771.9 | 71.98 | 227.63 | -1.106 | 0.687 | 1.251 | 1.334 | 0.27 |
|                     | Brachio-radialis | 1253.3 | 101.35| 320.51 | 0.136 | 0.687 | -1.229 | 1.334 | 0.703 |
| Supine Wider Grip Z Curl | Biceps  | 1702.2 | 118.47| 374.66 | 0.689 | 0.687 | -0.997 | 1.334 | 0.137 |
|                     | Brachio-radialis | 1140.1 | 41.18 | 130.24 | -0.716 | 0.687 | -0.689 | 1.334 | 0.263 |
| Concentrated Curl | Biceps  | 2193 | 76.62 | 242.29 | -1.088 | 0.687 | 0.785 | 1.334 | 0.184 |
|                     | Brachio-radialis | 1341.3 | 64.51 | 204.02 | -0.167 | 0.687 | 0.381 | 1.334 | 0.979 |
| Prone Lying Biceps Curl | Biceps  | 1638.6 | 102.98| 325.67 | 0.613 | 0.687 | 1.409 | 1.334 | 0.094 |
|                     | Brachio-radialis | 1235.8 | 144.21| 456.05 | 1.127 | 0.687 | 0.205 | 1.334 | 0.057 |
Figure 1 shows that in concentrated curl the activation of both the muscles i.e. Biceps Brachii and Brachioradialis was more than the other seven biceps curl exercises. In case of other seven biceps curl exercises, it appears to have almost similar muscles activation patterns.

Table 2: Mauchly’s Test of Sphericity and corrections

<table>
<thead>
<tr>
<th>Within-Subjects Effect</th>
<th>Mauchly’s W</th>
<th>Approx. Chi-Square</th>
<th>Df</th>
<th>Sig.</th>
<th>Epsilon</th>
<th>Greenhouse-Geisser</th>
<th>Huynh-Feldt</th>
<th>Lower-bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biceps Brachii</td>
<td>.000</td>
<td>52.906</td>
<td>27</td>
<td>.005</td>
<td>.394</td>
<td>.585</td>
<td>.143</td>
<td></td>
</tr>
<tr>
<td>Brachioradialis</td>
<td>.003</td>
<td>36.691</td>
<td>27</td>
<td>.157</td>
<td>.418</td>
<td>.642</td>
<td>.143</td>
<td></td>
</tr>
</tbody>
</table>

To test the equality of variances of the differences between the treatment levels, Mauchly’s Test of Sphericity was used. Repeated measures ANOVAs (within-subject factors) are particularly susceptible to the violation of the assumption of sphericity, as violation causes the test to become too liberal (i.e., an increase in the Type I error rate). Therefore, determining whether sphericity has been violated is very vital. The results of Table 2 shows that the assumption of sphericity has been violated as Mauchly’s test was significant. It means that the F-statistic is positively biased rendering it invalid and increasing the risk of a Type I error. To overcome this problem, corrections must be applied to the degrees of freedom (df), such that a valid critical F-value can be obtained. It should be noted that it is not uncommon to find that sphericity has been violated [8].

In SPSS, three corrections are generated: the Greenhouse-Geisser (1959), the Huynh-Feldt (1976), and the lower-bound. Each of these corrections has been developed to alter the degrees of freedom and produce an F-ratio where the Type I error rate is reduced. Of the three corrections, Huynh-Feldt is considered the least conservative, while Greenhouse-Geisser is considered more conservative and the lower-bound correction is the most conservative. Girden recommended that when epsilon is > .75, the Huynh-Feldt correction should be applied and when epsilon is < .75 or nothing is known about sphericity, the Greenhouse-Geisser correction should be applied. So here, in both the case Greenhouse-Geisser correction was applied [9].
Table 3: A summary of within repeated measure analysis of variance of eight different exercises with regard to muscles activation in Biceps Brachii and Brachioradialis

<table>
<thead>
<tr>
<th>Muscles</th>
<th>Groups</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biceps Brachii</td>
<td>Greenhouse-Geisser</td>
<td>2972874.687</td>
<td>2.757</td>
<td>1078270.66</td>
<td>7.231</td>
<td>.002</td>
</tr>
<tr>
<td></td>
<td>Error</td>
<td>3699928.188</td>
<td>24.814</td>
<td>149108.352</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brachioradialis</td>
<td>Greenhouse-Geisser</td>
<td>477071.550</td>
<td>2.929</td>
<td>162879.104</td>
<td>1.910</td>
<td>.154</td>
</tr>
<tr>
<td></td>
<td>Error</td>
<td>2248215.700</td>
<td>26.361</td>
<td>85285.916</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The muscle activation of Biceps Brachii showed significant differences related to all the eight biceps curl exercises. In the above table, the p-value is less than .05. Hence the F-ratio for Biceps Brachii is significant at 5% level. In this case, the null hypothesis is rejected; therefore at least one of the means will be different. Since ANOVA does not tell us where the difference lies; Bonferroni’s post hoc test was used to get the clear picture. The result of Bonferroni’s post hoc test shows that, in case of muscles activation of Biceps Brachii, except supine narrow grip Z-curl (SNGZC) and prone lying biceps curl (PLBC) all the other exercises reveal significant differences with the concentrated curl (CC).

According to Porcari, it’s important to note, that when training the biceps, other muscles such as the AD (Anterior Deltoid) and BR (Brachioradialis) can become involved in the lift, effectively taking a portion of the load away from the biceps, and thus reducing the relative effectiveness of that lift. With that in mind, researchers found that for the AD, the incline curl, concentration curl and the chin-up had significantly less muscle activation than the barbell curl. It means while performing the concentrated curl the muscles activation of Biceps Brachii is greater than other barbell curl exercises as the force is completely applied by these muscles. Also by placing the back of the arm on the top of the inner thigh while performing concentrated curl, it minimizes the involvement of other supporting muscles. Seated dumbbell concentrated curl is one of the popular biceps workouts for stimulating the muscle fibres on the peak of the biceps. But the most important thing, which most of the people neglect is to perform this exercise correctly for the optimum result.

No statistical difference was observed when comparing the muscle activation or the EMG responses of Brachioradialis muscle with the eight different biceps curl exercises. It means the EMG responses of the Brachioradialis muscles in selected biceps curl exercises were almost similar.

**Conclusion**

This study compared the muscle activity (Biceps Brachii and Brachioradialis) between eight different biceps curl exercises. Concentrated curl (CC) produced the maximum voluntary contraction and maximum muscles activation in Biceps Brachii as compared to other variations. All the exercises except supine narrow grip Z curl (SNGZC) and prone lying biceps curl (PLBC) revealed significant differences with the concentrated curl. Hence concentrated curl proved to be better for developing biceps as compared to the other five selected exercises. In the case of Brachioradialis muscle, no statistical difference was observed suggesting that all eight different biceps curl exercises may be similarly effective in activating the Brachioradialis muscles.

It will help the professional trainers and coaches to design training schedule for all level of Athletes which may consist of different variations of the biceps exercises. It may also help the physiotherapist and other medical professionals to prescribe exercises for better rehabilitation.

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** Necessary permissions for conducting the research were taken from Lakshmibai National Institute of Physical Education (LNIPE) Research Committee–Centre for Advanced Studies and Department of Exercise Physiology.

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Awareness of Health Insurance - Shifting Perspectives and Emerging Trends

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ABSTRACT

Introduction: Consumer awareness is one of the essential preconditions for regulated competition in health care. Studies carried out in various parts of India as well as globally have shown that the major contributing factors to the health insurance are the age, gender, income marital status occupation and awareness. In this scenario, the need arises to study the existing health insurance marketing trends and understand the perspectives of the consumers to develop a concrete awareness plan to attract and retain them.

Method: A descriptive study was carried out to understand sources of awareness regarding health insurance policy in Pune City. The population was studied for the preferences of contemporary marketing and traditional marketing. The traditional marketing includes advertisement in newspaper, television, referral by friends and family members and word of mouth by insurance agents. On the other hand the contemporary sources of awareness includes mailers, WhatsApp marketing and use of social media platforms.

Results: Out of 269 respondents in the study, 118 had preferred traditional marketing and 112 quoted contemporary marketing as sources of awareness. 29 respondents said that they came to know about the health insurance policies through traditional marketing but social media was helpful in providing additional details about the products. Use of social media platforms is a must in today’s world and the younger generation is more inclined towards it.

Conclusion: The study shows preferences of both the traditional as well as contemporary sources of awareness by the study population. Health insurance marketing perspectives have come a long way from the traditional “agent-client relationship” to “click to buy” health insurance policies. Age and income affects preferences of awareness.

Keywords: Health insurance awareness, traditional sources, contemporary sources

Introduction

Health Insurance is widely accepted as the most important measure towards UHC (Universal Health Coverage). The growing technical and managerial capacity of health insurance is widely recognized. With authorities like IRDA, ROHINI the previously unregulated HI (Health Insurance) market is much regulated now and heading towards standardization. With the growing Indian middleclass, the economic growth of the country by 2020 projects educated and aware population with high purchasing powers.¹

On the other side with rapid urbanization, rapid expansion of government sponsored health insurance schemes, technology integration and standardization of healthcare processes, the penetration of health insurance is obvious. The factors affecting the consumer’s choice and readiness to purchase insurance play an important role in the percolation of Health insurance plans. With increasing number of insurance products, the buyer having purchasing power will purchase only if the consumer is aware of the policy and its benefits. Therefore, there is

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always a need to study factors leading to awareness of health insurance. The consumers perspective along with the insurers perspective needs to be analyzed to develop and deliver insurance awareness plans suite to the need of the all segments of population.2,3

Consumer awareness is one of the essential preconditions for regulated competition in health care. Studies carried out in various part of India as well as globally have shown that the major contributing factors to the health insurance are the age, gender, income marital status occupation and awareness. On the supply side of health insurance the marketing and advertising is important as it serves as the basis of awareness and benefits of the products.

Studies from the developing countries show that income, education and health risks are the major factors affecting purchase of health insurance.4 However in the developing countries the most significant barrier in the purchase decision is the income. In the developing countries including India the purchase of health insurance is also accompanied by socioeconomic & socio cultural practices. Studies have stated a strong influence of societal component in purchase decision.

There exits a low awareness about the health insurance among the insured as well as the insured categories the uninsured being the least aware.5 Furthermore he states that on the supply side the suppliers of health studies insurance are less motivated which can be directly correlated with the less incentive for the insurance advisors.

In a study on customers perception towards health insurance in Bardoli and Mandvi region studies correlation between income and interest of an individual towards purchase of health insurance. Study demonstrated a strong association between income and interest.7

Studies also examine awareness & willingness to pay for health insurance in the city of Coimbatore. The study also explored various factors, which act as impediments to join health insurance.8 Majority out of the 225 respondents were willing to join Health Insurance. Moreover, significant association exists between awareness, age, education, monthly income and willingness.9

Several studies also examined the current practices and emerging trends in health insurance for low income segment in India and concluded that health insurance schemes have considerable scope of improvement. Studies recommend that regulatory and delivery mechanisms needs to be channelized. There is a need for coordination and collaboration among multiple agencies to strengthen the health insurance. 10 Apart from the economic conditions, poor awareness initiatives are also cause of low awareness.11,12

Consumers today can choose from a wide range of insurance products. There are various options in terms of deductibles, provider networks, coverage of specific services and medications, and out-of-pocket prices.13,14 Even at the time of purchasing insurance policy, most consumers have limited information about the benefits of the policy. In this scenario, the need arises to study the existing health insurance marketing trends and understand the perspectives of the consumers to develop a concrete awareness plan to attract and retain consumers.13

**Aim & Objectives of the Study**

1. To study the sources of awareness regarding health insurance products.

2. To understand the consumers preferences of contemporary sources of awareness over traditional sources.

3. To understand the emerging trends in health insurance marketing.

**Methodology**

A descriptive study was carried out to understand awareness regarding health insurance policy. Data was collected through a questionnaire from individuals enrolled in voluntary health insurance policies in Pune City. Questionnaire included data on different socio-economic variables like age, income, gender, education & occupation. Other important parameters on which information was gathered included sources of awareness related to health insurance policies and understanding consumer’s preferences of contemporary sources of awareness over traditional sources. The questionnaire was circulated to 360 individuals out of which 269 responded and filled the complete questionnaire.91 questionnaire were rejected due to incomplete information.

The inclusion criteria were limited to individuals enrolled in voluntary health insurance. Those individuals
who were enrolled in some form of group health insurance through employer or any other firm were excluded from the study. Further, this population was studied for the preferences of contemporary marketing and traditional marketing. The traditional marketing includes advertisement in newspaper, television, referral by friends and family members and word of mouth by insurance agents. On the other hand, the contemporary sources of awareness include mailers, watsapp marketing and use of social media marketing.

The study period was January 2017 to August 2017. The analysis of the data was carried out using Microsoft excel.

Data Analysis and Results

The total sample size included in the study was 269. Out of 269 respondents 118 had preferred traditional marketing and 112 quoted contemporary marketing as sources of awareness. 29 respondents said that they came to know about the health insurance policies through traditional marketing but social media was helpful in providing additional details about the products.

Below mentioned table depicts the descriptive statistics of the study participants. This includes gender, age, income, education and sources of awareness of health insurance.

<table>
<thead>
<tr>
<th>Table 1: Descriptive statistics of the participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Age</strong></td>
</tr>
<tr>
<td>Less than 30</td>
</tr>
<tr>
<td>30-40</td>
</tr>
<tr>
<td>40-50</td>
</tr>
<tr>
<td>More than 50</td>
</tr>
<tr>
<td><strong>Education</strong></td>
</tr>
<tr>
<td>Primary</td>
</tr>
<tr>
<td>Graduation</td>
</tr>
<tr>
<td>Post-graduation</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
</tr>
<tr>
<td>Self employed</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Service</td>
</tr>
<tr>
<td>Retired</td>
</tr>
<tr>
<td>Unemployed</td>
</tr>
</tbody>
</table>

Table 1 shows that significant proportion of the sample were male members i.e. 63 %. Female participants were 37%. Majority of the respondents belonged to the age groups of 30-40 years. Majority of respondents were graduate followed by higher education and post-graduation and were employed. As regards the income, a major percentage of the respondents were having annual income of more than 2 lacs.
Fig. 1 shows that there exists different preferences in sources of awareness. Television commercials were preferred the most by about 28% respondents. Internet and social media followed this, which was found to be 24%. 12% of the respondents said that they got awareness through insurance agents.

Table 2: Comparison of age & income of traditional sources and contemporary sources of health insurance awareness

<table>
<thead>
<tr>
<th>Age</th>
<th>N= Traditional sources</th>
<th>Mean</th>
<th>N= Contemporary sources</th>
<th>Mean</th>
<th>N= Both</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30</td>
<td>118</td>
<td>46.45</td>
<td>112</td>
<td>31.5</td>
<td>29</td>
<td>42</td>
</tr>
<tr>
<td>30-40</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>40-50</td>
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<tr>
<td>More than 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income per annum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than Rs 50000</td>
<td>118</td>
<td>5.6 L</td>
<td>112</td>
<td>7.6 L</td>
<td>29</td>
<td>6.5</td>
</tr>
<tr>
<td>Rs 50000-100000</td>
<td></td>
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<tr>
<td>Rs 100000-150000</td>
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<tr>
<td>Rs 150000-200000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Above Rs 200000</td>
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</tr>
</tbody>
</table>

Table 2 depicts the comparison of age & income of participants preferring traditional sources and contemporary sources of health insurance awareness. The mean age of the participants who preferred traditional sources was 46.5 years and was much higher than the group who preferred contemporary sources. The mean age of participants using both sources was 42 years.

As regards the income, the mean income of the traditional source group was 5.6 lacs, which is lower than the contemporary group whose mean income was 7.6 lacs. The third group using both traditional and contemporary sources had mean income of 6.5 lacs.

Discussion

The study aims to understand preferences of the participants regarding the awareness of health insurance. In addition, it examines the shifting perspectives and emerging trends in creating awareness about health insurance products. The marketing of health insurance has come along way from the agent client relation to the “just a click” policy of purchase.

Health insurance is an emerging concept & the people are aware about it. However, the sources of awareness range from traditional means to the contemporary ones. The sources mainly consists of TV followed by newspaper, insurance agents, family & friends etc. and the much in trend social media marketing. Judicious use of social media in creating awareness is the contemporary form of marketing for various products and healthcare is no different. Thus in the current scenarios the insurance companies need to focus on contemporary marketing techniques too along with the traditional sources of awareness. The age group 30-40 years was found to prefer the social media sources for awareness ranging from email marketing, social media platforms like Facebook, Instagram, WhatsApp & YouTube marketing.

Due to the enhanced digital technology, the information communicated on social media reaches faster, can be retrieved anytime and lasts longer as compared to the traditional means. Also, there are websites like policy bazaar.com, coverfox.com, bankbazaar.com etc which allows one to understand the policy and compare the benefits with other policies in just one click. In such scenario, a comprehensive strategy is required to use all possible platforms to spread awareness regarding the health insurance products.

The mean age of the participants who preferred traditional sources higher than the group who preferred contemporary sources. The mean age of participants using both sources was 42 years. This shows that different
age group have different preferences for awareness. The study also shows that younger age group have higher income and are more inclined towards the social media marketing. This suggests that the awareness sources needs to be such that the potential group ranging between 30 -40 years of age can be targeted & attracted easily.

Although there is digital media boom, the role of traditional sources of awareness still play a major role. 44% percentage of people in age group 40 – 50 years of age still preferred print media and TV as traditional sources of information and conveyed them to be the potential source. About 10% of the population said that they got the information from the traditional sources but social media was effective in obtaining additional information about the products. The mean age of the population was 40 who used both the sources.

For about 12 % of the study population the agents were the only source of insurance policies and they purchased the policy solely through the influence of the agents. Other sources like radio also contributed to awareness in 14 % of the study population.

This study brings out the need of a comprehensive plan by health insurance companies for spreading awareness. The plan should include a mix of traditional and contemporary sources of awareness to reach to its target audience.

Conclusion

The study shows preferences of both the traditional as well as contemporary sources of awareness by the study population. Health insurance marketing perspectives have come a long way from the traditional “agent-client relationship” to “click to buy” health insurance policies. Age and income affects preferences of awareness.

Use of social media platforms is must in today’s world and the younger generation is more inclined towards it. There exists a need by the insurance companies to market their products on contemporary as well traditional awareness platforms.

Source of Funding: Nil

Conflict of Interest: None

Ethical Clearance: IEC of Symbiosis International (Deemed University)

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Retention of Cognitive Skills Acquired in Heartsaver First Aid CPR AED Course of American Heart Association (AHA), USA among Non-medical Students in Pune City

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ABSTRACT

Introduction: Anywhere, anytime, anyone can face a medical emergency!!

It could be at your workplace, public place or your home; it could be your colleague, your friend or yourself. About 70 percent of out-of-hospital cardiac arrests happen at home and workplace. Cardiopulmonary resuscitation (CPR) and Automated External Defibrillator (AED) if used appropriately and immediately can significantly impact survival of patients. The American Heart Association – Heartsaver First Aid CPR AED course is specially designed to prepare an individual to provide First Aid, CPR and AED in a safe timely and effective manner.

Objective: Of the study is to test the retention of cognitive skills acquired during the AHA – Heartsaver First Aid CPR AED course at the end of four weeks.

Materials and Method: The interventional study was conducted amongst 244 Post Graduate Management students based in Pune. The students were of the age group 20 – 27. In order to assess the impact of the AHA - Heartsaver First Aid CPR AED training, the students chosen, had not undergone any previous, formal training in First Aid and CPR concepts. The respondents were assessed with a pre-designed 15 item Multiple Choice Questionnaire provided by the American Heart Association (AHA). The respondents were then subjected to a one day training on correct First Aid practices called AHA – Heartsaver CPR AED protocol. After the training session the respondents were subjected to the same questionnaire provided by AHA to evaluate their immediate post training knowledge. To assess the knowledge retention of acquired cognitive skills among respondents, the same questionnaire was administered to the respondents after a gap of four weeks. Data was analyzed using means and paired ‘t’. test to ascertain significance. SPSS version 23.0 was utilized for analysis.

Discussion: The low pre-test scores clearly indicate the lack of knowledge regarding Heartsaver First Aid CPR AED among non-medical students. The significant increase obtained in the immediate post training test points towards effectiveness of communication regarding safe and timely first aid and CPR practices. The retention test scores show a significant drop from the immediate post training test scores.

Conclusion: The program although successfully transfers knowledge but requires periodic reinforcement to ensure long term retention and application in a real world emergency.

A key reason behind the drop in scores could be the lack of exposure to medical emergencies as it does not feature in their management curriculum. Regular refresher workshops can ensure their continued interest and retention of the cognitive skills.

Keywords: Cardio-Pulmonary Resuscitation, Automated External Defibrillator.
Introduction

Anywhere, anytime, anyone can face a medical emergency!!

It could be at your workplace, public place or your home; It could be your colleague, your friend or yourself!!

If you have faced such an emergency, you will realize how important it is to know what exactly to do in the first crucial moments before a doctor or an ambulance arrives. Statistics prove that anywhere, in the world, even with the best of emergency medical services available, it takes a minimum of 10 minutes before the arrival of expert medical care. A sound knowledge of First Aid therefore is a must. It can make all the difference: it can save lives!

About 70 percent of out-of-hospital cardiac arrests happen at home and workplace. And in most of the cases death occurs before the victim can get any medical treatment.\(^1\) Cardiopulmonary resuscitation (CPR) and Automated External Defibrillator (AED) if used appropriately and immediately can significantly impact survival of patients.\(^2\) The awareness of emergency medical services amongst medical students in India remains low.\(^3\) It has been shown that even the first aid knowledge amongst undergraduate students is poor.\(^4\) Thus it is expected that most people not hailing from medical background do not possess formal training in First Aid CPR & AED usage. Very less studies have been conducted to assess the knowledge of Heartsaver First Aid CPR AED amongst non-medical students.

The American Heart Association – Heartsaver First Aid CPR AED course is specially designed for anyone with little or no medical training. The course is designed to prepare an individual to provide First Aid, CPR and use an Automated External Defibrillator (AED) in a safe timely and effective manner. The course is Instructor led, video based and includes Hands on training.

Cognitive skills are human skills of information processing. It includes knowledge gained and understood because of thinking, experience and attention. The students undergoing the AHA – Heartsaver First Aid CPR AED course are expected to retain the knowledge gained for application in the future. The challenge with retention of acquired knowledge on medical emergencies among non-medical students is that, retention of the concepts are not refreshed after the one day course. Studies have found that retention of Heartsaver First Aid CPR AED skills in undergraduate medical students is low.\(^5\)

Objective

Of the study is to test the retention of cognitive skills acquired during the AHA–Heartsaver First Aid CPR AED course at the end of four weeks.

Methodology

This interventional study was conducted amongst 244 Post Graduate Management students based in Pune. The students were of the age group 20 – 27. In order to assess the impact of the AHA - Heartsaver First Aid CPR AED training, the students chosen, had not undergone any previous, formal training in First Aid and CPR concepts. The respondents were assessed with a pre-designed 15 item Multiple Choice Questionnaire provided by the American Heart Association (AHA). The questions dealt with management of common first aid emergencies including trauma, bleeding, CPR in both adult and children and application of AED. Also the knowledge regarding, approach towards patient was assessed. The respondents were then subjected to a one day training on correct First Aid practices called AHA – Heartsaver CPR AED protocol. The training session lasted for 8 hours.

The sessions were conducted by AHA – certified instructors. The tools used in training included video based sessions and hands on training on low fidelity manikins. Four such sessions were conducted to cover 244 students in batches of approximately 60 students each. After the training session the respondents were subjected to the same questionnaire provided by AHA to evaluate their immediate post training knowledge. To assess the knowledge retention of acquired cognitive skills among respondents, the same questionnaire was administered to the respondents after a gap of four weeks. Data was analyzed using means and paired ‘t’. test to ascertain significance.

SPSS version 23.0 was utilized for analysis.

Result

Table 1: shows the mean and standard deviation of the pre-test, immediate posttest and knowledge retention after four weeks

<table>
<thead>
<tr>
<th>Paired Samples Statistics</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Test Score</td>
<td>5.99</td>
<td>1.93</td>
</tr>
<tr>
<td>Post Test Score</td>
<td>12.36</td>
<td>1.62</td>
</tr>
<tr>
<td>Knowledge Retention Score</td>
<td>10.25</td>
<td>2.58</td>
</tr>
</tbody>
</table>

The mean pretest score was 5.99 ± 1.93 while the students showed significant improvement in the post training test scoring an average of 12.36 ± 1.62. However, the average score obtained in the retention test
conducted four weeks later developed to 10.25 ± 2.58. This clearly indicates decline in the retention of skills as compared to immediate posttest.

**Table 2: shows the statistical analysis between the paired samples with 95% confidence intervals (p<0.05)**

<table>
<thead>
<tr>
<th>Paired Samples Test</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Test Score - Post Test Score</td>
<td>38.93</td>
<td>0.00</td>
</tr>
<tr>
<td>Post Test Score - Knowledge Retention Score</td>
<td>12.76</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 2 represents the results of paired t-test between paired samples (pre & post –test) which is found (38.93) with 95% level of significance (p<0.05) hence, may conclude that the training on Heartsaver First Aid CPR and AED skills is found significant. As well as paired sample (post- test and knowledge retention) is found (12.76) with 95% level of significance (p<0.005), hence may conclude that knowledge retention regarding Heartsaver First Aid CPR and AED skills after four weeks is still significant.

**Discussion**

The low pre-test scores clearly indicate the lack of knowledge regarding Heartsaver First Aid CPR AED among non-medical students. The significant increase obtained in the immediate post training test points towards effectiveness of communication regarding safe and timely first aid and CPR practices. However the program can be truly effective if the cognitive skills taught are retained by the students. It is expected that the students might apply the knowledge gained anytime in future. The retention test scores show a drop from the immediate post training test scores. This result raises alarm on the long term retention and usability of Heartsaver First Aid CPR AED skills acquired in the program.

**Conclusions**

The program although successfully transfers knowledge but requires periodic reinforcement to ensure long term retention and application in emergency.

A key reason behind the drop in scores could be the lack of exposure to medical emergencies as it does not feature in their management curriculum. Regular refresher workshops can ensure their continued interest and retention of the cognitive skills.

**Ethical Clearance:** IEC, SIU

**Source of Funding:** Nil

**Conflict of Interest:** Nil

**REFERENCES**


Contraception Use: Does Socio Economic Factors Matter in Maharashtra, India? An Investigation through NFHS-4 Data

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ABSTRACT

Introduction: Reproductive health care is the collection of preventive methods, techniques and indicators that contribute towards healthy and reproductive well-being. Under reproductive health and rights, it is the right of every women and men to be informed about the contraceptive choices and to have access to quality family planning techniques.

Objective: The research paper examines the use of modern limiting, spacing and traditional methods of contraceptives among tribal and non-tribal women of Maharashtra. It also attempts to study the factors associated with the current use of modern methods of contraceptives in Maharashtra. The reason behind lack of contraceptive usage is analyzed.

Method: The NFHS IV (2015-16) data published by Ministry of Health and Family Welfare (MoHFW) is used for the study. The data on family planning is accessed from woman questionnaire of the survey with a sample size of 29,460 women of Maharashtra. The data is analyzed using SPSS by applying binary logistic regression method.

Results: The use of modern contraceptives in association with place of residence, age, education, wealth index among the young couples of both tribal and non-tribal married women is found. Unmet need for High Priority Districts (HPS’s) and a district wise trend for modern use of contraceptives among tribal and non-tribal women is analyzed.

Conclusion: The findings of research study will contribute to identify the various socio cultural, demographic and community-based interventions which can significantly improve the modern contraceptive usage among married couples of Maharashtra.

Keywords: Contraceptives, tribe, Maharashtra, logistic regression

Introduction

Reproductive health presents a lifelong continuous process associated with various stages of women in the family and society.¹ It should ensure safe and healthy sex life by using a collection of preventive methods and techniques. In 1951, India was the first country to launch National Family Welfare program (NFWP). Over the decades, the NFWP has seen a paradigm shift from population control to integrated approach with the National Rural Health Mission (NRHM). With NRHM, there was an integrated approach adopted applying both health and demographic specific indicators under NFWP. The revised goals not only aim at population control, it also includes protection of reproductive rights of women, to reduce Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) by increasing availability and accessibility towards modern contraceptive methods. Contraceptive usage and family planning correlates highly with the indicators maternal and child health. According to Sample Registration System (SRS) 2014 – 16 MMR in India has reduced from 167 per 1,00,000 live births to 130 per 1,00,000 livebirths. Total fertility has reduced from 2.7 (NFHS 3 2005-06) to 2.2 (NFHS 4 2015-16). IMR has fallen reduced to 41 per 1000 live births (NFHS 4 2015-16) from 57 per 1000 live births (NFHS 3 2005-06).² ²
Study Background

Maharashtra, which extends from a west central part of India, is a second most populous state of the country. In spite of being the populated state, Maharashtra has achieved desirable replacement fertility level of 1.9 (NFHS 4 2015-16). MMR of Maharashtra is 61 per 1,00,000 livebirths (SRS 2014-16) and IMR is 24 per 1000 live births (NFHS 4 2015-16). Despite of improved maternal and child health indicators, the major burden (50.7 percent) of using contraceptive methods and family planning lies on women. Use of any modern method has reduced to 64.8 percent (NFHS 4 2015-16) from 66.9 percent (NFHS 3 2005-06). Although wide range of contraceptive methods are made available, utilization is highly skewed towards female sterilization. Male sterilization has significantly fallen to 0.4 percent (NFHS 4 2015-16) from 2.1 percent (NFHS 3 2005-06). This calls for a research towards the burden on women and other influencing factors towards various methods of contraceptive use.

Research Objective

- To study the unmet need for family planning among the tribal and non-tribal of High Priority Districts (HPD’s) of Maharashtra.
- To study the district wise use of modern contraceptives among tribal and non-tribal women of Maharashtra
- To analyze the current use of modern limiting, modern spacing and traditional methods among currently married women of tribal and non-tribal with background characteristics.
- To analyze the factors associated with current use of any modern method of contraceptives among currently married tribal and non-tribal women of Maharashtra.

Research Methodology

National Family Health Survey (NFHS) is a large-scale representative household sample survey funded by United States Agency for International Development (USAID). The data collected as a part of women’s questionnaire in the fourth round of NFHS (2015 – 16) has been used for the study. The data on family planning and contraceptive usage is accessed from women’s questionnaire which has covered 29,460 women (15 to 49 years). A district wise analysis on modern use of contraceptives, unmet need for modern limiting and modern spacing by married tribal and non-tribal women is mapped using ArcGIS. The research study has also analyzed the use of modern limiting, modern spacing and traditional methods in association with age, education, place of residence, wealth status among the tribal and non-tribal population of Maharashtra by applying simple logistic regression using SPSS. It also attempts to study the factors associated with the current use of modern methods of contraceptives among tribal and non-tribal women of Maharashtra.

Unmet need for family planning: NFHS III and IV shows that unmet need for family planning in Maharashtra has failed to show significant change in the past 10 years. NFHS IV (2015-16) shows that unmet need for family planning is 10 percent which has slightly increased from 9.7 percent (NFHS III 2005-06). Unmet need for family planning can be further divided into unmet need for limiting and unmet need for spacing. The nine districts of Maharashtra are categorized as HPD’s as recommended under RMNCH+A by Government of Maharashtra. It was observed that unmet need for spacing is significantly high among non-tribal women (9.6 percent) than tribal women (4.3 percent). Unmet need for limiting is almost same among non-tribal women (43.1 percent) and tribal women (42.6 percent). The unmet need for limiting is higher among tribal women in Bid (57.1 percent), Hingoli (50 percent), Jalgaon (49.1 percent) Nanded (46.2 percent), Dhule (45.4 percent) when compared to non-tribal women. Even the unmet need for spacing is higher among non-tribal women than the tribal women of Jalna (10.7 percent), Jalgaon (9.7 percent), Bid (9 percent), Nandurbar (7.6 percent), Dhule (7.2 percent), Nanded (4.3 percent), Gadchiroli (3.9 percent) districts. The unmet need for spacing is high among tribal women in Aurangabad (17 percent) than non-tribal women. (Figure 1 and Figure 2)
Figure 1: Maps representing usage of modern limiting and spacing methods of High Priority Districts (HPD’s)
Figure 2: Maps representing district level variations in usage of modern contraceptive methods
Factors associated with the current use of any modern contraceptives: Binary logistic regression was used to determine the odds ratio for the factors associated with the current use of any modern method of contraception. Independent variables used for the analysis were place of residence, age of the respondent, religion, education of the respondent, wealth index, number of surviving daughters and number of surviving sons to a woman. Respondent currently using any type of modern contraceptive was a dichotomous dependent variable. It was observed that place of residence, age, religion, wealth index, number of surviving sons, number of surviving daughters and exposure to mass media is more statistically significant variables towards the use of modern contraceptives. The odds ratio predicts use of modern contraceptives among tribal women increases with increasing age, middle, richer and richest families, families with more than one surviving son and daughters. Non-tribal women with increasing age, education, wealth index, number of surviving sons and mass media exposure there is significant increase in the use of modern contraceptives. Decreasing trend is observed in the use of modern contraceptives among the non-tribal women with more than two surviving daughters.

Table 1: Factors associated with the current use of modern contraceptives among married women (15–49 years) of Maharashtra

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<thead>
<tr>
<th>Background characteristics</th>
<th>Tribal women</th>
<th>Non-tribal Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Exp(β)]</td>
<td>95 % C.I for Exp(β)</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Place of residence</td>
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<tr>
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<tr>
<td>Rural</td>
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</tr>
<tr>
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</tr>
<tr>
<td>15-24®</td>
<td>3.38***</td>
<td>2.59</td>
</tr>
<tr>
<td>25-34</td>
<td>4.41</td>
<td></td>
</tr>
<tr>
<td>35 and above</td>
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</tr>
<tr>
<td>Religion</td>
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<td></td>
</tr>
<tr>
<td>Hindu®</td>
<td>0.24***</td>
<td>0.39</td>
</tr>
<tr>
<td>Others</td>
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</tr>
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<tr>
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<td>Primary</td>
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<tr>
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<td>Higher</td>
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<tr>
<td>Wealth Index</td>
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<td></td>
</tr>
<tr>
<td>Poorest®</td>
<td>1.18</td>
<td>0.87</td>
</tr>
<tr>
<td>Middle</td>
<td>1.48**</td>
<td>1.04</td>
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<tr>
<td>Richer</td>
<td>1.73***</td>
<td>1.16</td>
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<td>Richest</td>
<td>1.85***</td>
<td>1.11</td>
</tr>
<tr>
<td>No of surviving sons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No son®</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One son</td>
<td>6.31***</td>
<td>4.84</td>
</tr>
<tr>
<td>Two Son</td>
<td>21.73***</td>
<td>15.44</td>
</tr>
<tr>
<td>Three or more sons</td>
<td>25.71***</td>
<td>14.56</td>
</tr>
<tr>
<td>No of surviving Daughters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Daughter®</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One daughter</td>
<td>3.64***</td>
<td>2.81</td>
</tr>
<tr>
<td>Two Daughters</td>
<td>4.69***</td>
<td>3.38</td>
</tr>
<tr>
<td>Three or more Daughters</td>
<td>5.85***</td>
<td>3.83</td>
</tr>
</tbody>
</table>
Continued…

| Mass media                                      | Not exposed® | Low exposure | | Moderate exposed | | Fully exposed |
|-------------------------------------------------|--------------|--------------|--------------|-----------------|--------------|
| ® Reference category; *** 1% Significant level; ** 5% Significant level; *10% Significant level; 95% of Confidence Interval (C.I) for Exp(β) | | | | | |
| Use of modern limiting, modern spacing and traditional methods of contraceptives with background characteristics: Odds ratio was generated for current use of modern limiting, modern spacing and traditional methods associated with the various socio-economic and cultural factors using binary logistic regression. It was found that among tribal women place of residence, age, religion, education, play a statistically significant role with the use of modern limiting and spacing methods. In addition, for tribal women wealth index is found statically significant for modern spacing and mass media for modern limiting methods. Among non-tribal women place of residence, age, religion, wealth index and mass media are found to be statistically significant for modern limiting and spacing methods. Use of modern limiting and spacing methods is more likely to increase with increasing age among both tribes and non-tribes. With the increasing education and wealth index, more women are likely to adopt various spacing and limiting methods. Among non-tribal women with the use of traditional methods place of residence, age and education is observed to be more statistically significant. Among both tribes and non-tribes with increasing levels of wealth index there has been increase in the use of modern spacing methods. Among the non-tribal women, with the increasing exposure to mass media it is more likely to increase the use of modern spacing method, and less likely to increase the use of limiting and traditional methods. |
Table 2: Current use of Modern limiting, Modern spacing and traditional methods among currently married women (15 -49years) with background characteristics

<table>
<thead>
<tr>
<th>Background characteristics</th>
<th>Modern Limiting</th>
<th>Modern spacing</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tribe [Exp(β)]</td>
<td>95 % C.I for Exp(β) (Lower, Higher)</td>
<td>Tribe [Exp(β)]</td>
</tr>
<tr>
<td>Tribe</td>
<td>[Exp(β)]</td>
<td>95 % C.I for Exp(β) (Lower, Higher)</td>
<td>Tribe [Exp(β)]</td>
</tr>
<tr>
<td></td>
<td>Non–Tribe [Exp(β)]</td>
<td>95 % C.I for Exp(β) (Lower, Higher)</td>
<td>Non–Tribe [Exp(β)]</td>
</tr>
</tbody>
</table>

Place of residence

<table>
<thead>
<tr>
<th>Place of residence</th>
<th>Modern Limiting</th>
<th>Modern spacing</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban®</td>
<td>1.94***</td>
<td>1.6***</td>
<td>0.77</td>
</tr>
<tr>
<td>Rural</td>
<td>1.46,2.56</td>
<td>1.55,1.81</td>
<td>0.31,1.89</td>
</tr>
</tbody>
</table>

Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Modern Limiting</th>
<th>Modern spacing</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24®</td>
<td>9.05***</td>
<td>7.3,9.35</td>
<td>0.69</td>
</tr>
<tr>
<td>25-34</td>
<td>6.98,11.73</td>
<td>7.9,10.07</td>
<td>0.86</td>
</tr>
<tr>
<td>35 &amp;above</td>
<td>23.39***</td>
<td>22.2,28.6</td>
<td>0.62***</td>
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</table>

Religion

<table>
<thead>
<tr>
<th>Religion</th>
<th>Modern Limiting</th>
<th>Modern spacing</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu®</td>
<td>0.36***</td>
<td>0.87***</td>
<td>Insufficient data for analysis</td>
</tr>
<tr>
<td>Others</td>
<td>0.23,0.58</td>
<td>0.8,0.94</td>
<td>Insufficient data for analysis</td>
</tr>
</tbody>
</table>

Education

<table>
<thead>
<tr>
<th>Education</th>
<th>Modern Limiting</th>
<th>Modern spacing</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>No education®</td>
<td></td>
<td></td>
<td>Insufficient data for analysis</td>
</tr>
<tr>
<td>Primary</td>
<td>0.88</td>
<td>0.67,1.17</td>
<td>0.47</td>
</tr>
<tr>
<td>Secondary</td>
<td>0.58***</td>
<td>0.57,0.71</td>
<td>0.42</td>
</tr>
<tr>
<td>Higher</td>
<td>0.12***</td>
<td>0.19,0.26</td>
<td>0.89</td>
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</table>

Wealth Index

<table>
<thead>
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<th>Wealth Index</th>
<th>Modern Limiting</th>
<th>Modern spacing</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poorest®</td>
<td>1.01</td>
<td>0.74,1.07</td>
<td>1.48</td>
</tr>
<tr>
<td>Middle®</td>
<td>1.18</td>
<td>0.67,0.97</td>
<td>1.68</td>
</tr>
<tr>
<td>Richer®</td>
<td>0.90</td>
<td>0.71,1.03</td>
<td>1.78</td>
</tr>
<tr>
<td>Richest®</td>
<td>1.48</td>
<td>0.93,2.34</td>
<td>Insufficient data for analysis</td>
</tr>
</tbody>
</table>

Mass media

<table>
<thead>
<tr>
<th>Mass media</th>
<th>Modern Limiting</th>
<th>Modern spacing</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not exposed®</td>
<td></td>
<td></td>
<td>Insufficient data for analysis</td>
</tr>
<tr>
<td>Low exposure</td>
<td>1.46***</td>
<td>1.02,1.32</td>
<td>0.53</td>
</tr>
<tr>
<td>Moderately exposed</td>
<td>1.23</td>
<td>1.06</td>
<td>0.55,2.05</td>
</tr>
<tr>
<td>Fully exposed</td>
<td>1.08</td>
<td>1.35</td>
<td>0.55,3.37</td>
</tr>
</tbody>
</table>

® Reference category; *** 1% Significant level; ** 5% Significant level; *10% Significant level; 95% of Confidence Interval (C.I) for Exp(β)
Reason for not using contraceptives: The analyzed results showed that, the major reason for not using contraceptives among both tribal and non-tribal women was observed to be 'strong desire to become pregnant' (figure 3). Desire to become pregnant is found dominantly among the tribal (59.3 percent) than non-tribal women (50 percent). Among tribal women major reasons for less likely to use contraceptives was desire to become pregnant (59.3 percent), fear of side effects or health concerns (12.6 percent), became pregnant (7.9 percent), wanted more effective method (4.6 percent), disapproval faced from husband (2.8 percent), created menstrual problem (2.3 percent), did not like the method (2.2 percent), infrequent sexual activity as husband was away (1.6 percent), menopause (0.7 percent) and lack of sexual satisfaction (0.3 percent).

![Figure 3: Reasons for not using contraceptives](image)

Discussion

The analyses from the research study shows the use of modern contraceptive method among tribal women (61.3 percent) and non-tribal women (62.6 percent) are observed almost to be same. The findings observed was the use of traditional method was significantly higher among the non-tribal women (2.4 percent) than tribal women (1.5 percent). The trend in the usage pattern of modern limiting methods is higher among tribal women (54.8 percent) than non-tribal women (50.6 percent) whereas use of modern spacing methods is significantly high among the non-tribal women (12 percent) compared tribal women (6.6 percent). This clearly shows lack of awareness among tribal women towards various spacing methods. With the above evidence, female sterilization (53.9 percent) and male sterilization (0.9 percent) is high among the tribal women than the female sterilization (50.2 percent) and male sterilization (0.4 percent) among the non-tribes. Use of pill, condoms, IUD are lower among the tribal women than the non-tribal women. In addition, it was found that use of modern contraceptives is lowest among the tribal women of Ratnagiri (25 percent), Sangli (33.3 percent), Kolhapur (31.6 percent) and Sindhudurg (20 percent). Another major finding of the research study is unmet need for spacing is significantly high among the non-tribal women (9.6 percent) that tribal women (4.3 percent) of High Priority Districts (HPS’s). Among non-tribal women Hingoli (7.3 percent), Bid (9 percent), Jalna (10.7 percent), Jalgaon (9.7 percent), Dhule (7.2 percent), Nandurbar (7.6 percent) has high level of unmet need for spacing. It implies a challenge placed before the health system to ensure availability and promote accessibility of various contraceptive spacing methods. It also recommends for refocus and re-strategize family planning program towards availability and accessibility of different modern contraceptive methods.

The research study finds an evidence that factors such as place of residence, age, wealth index, no of
surviving sons and number of surviving daughters, exposure to mass media significantly influences the use of modern contraceptive methods among tribal and non-tribal women. Especially use of modern spacing methods among non-tribes is significantly observed associated with place of residence, age, education, religion, wealth index and exposure to mass media. The above-mentioned factors should be tapped in an efficient way by the policy makers and health programs to increase the awareness and accessibility of modern spacing methods among non-tribal women. The objective of such reoriented program should not be merely to encourage the use of contraceptives but also to ensure informed decision making. The analyses for major reasons for discontinuation of contraceptives among tribal and non-tribal women are desire to become pregnant, became pregnant, health concerns, wanted more effective method and disapproval faced from husband. Interestingly, it was observed that the other reasons reported only by non-tribal women were lack of privacy (1.1 percent), inconvenient to use (0.4 percent), access and availability problem (0.6 percent) and gaining weight (1.7 percent). Though the percentage reported is found to be low, there is high possibility of these women shifting towards traditional methods of contraception. This calls for strengthening the availability and accessibility of modern contraceptives of family planning program. Along with accessibility and availability of modern contraceptives it should also be supplemented by mass media-based campaigns, spreading messages towards larger segment of targeted women and grassroot level health workers.

**Conflict of Interest Statement:** The authors (Dr. Arindam Das, Shobana Sivaraman and Kailash Prajapati) confirm that there are no known conflicts of interest associated with this publication and there has been no financial support for this work that could have influenced its outcome.

**Source of Funding:** The research work has no source of funding.

**Ethical Clearance:** NFHS - 4 is the secondary data which is used for the research. It is an open access data and hence it may not require an ethical clearance.

**REFERENCES**


Disease Patterns among Rural Residents—An Explorative Qualitative Study with Physicians in Private Practice of a Village in Western Maharashtra, India

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¹Assistant Professor; ²Head, Symbiosis Community Outreach Programme and Extension (SCOPE), Faculty of Health and Biological Sciences, Symbiosis International (Deemed) University, Lavale, Mulshi, Pune

ABSTRACT

Objectives: Health is not mere absence of disease; it is a sense of well-being. Important to understand health problems of rural residents as they have limited access to health care facilities. The objective was to identify pattern of diseases in order to plan and build correct health interventions.

Novelty/Originality: The research would contribute in building health interventions.

Method: Explorative qualitative design, in depth interviews with 10 private medical doctors practicing in a village.

Results & Discussions: Hypertensions, diabetes, anaemia, malaria, dengue, malnutrition, worm infestations among children. The study revealed possible reasons of high risk behaviour and lifestyle, water and sanitation issues, lack of knowledge and awareness for the disease pattern in the community.

Application: The findings could be helpful to do surveys the findings of which could be generalized to larger rural community.

Conclusion: Comprehensive health education sessions for different age groups, target oriented interventions collaboration with government health facilities would improve the health status.

Keywords: Diseases, Rural population, Health facility

Introduction

India a fastest growing economy in the world and now considered as lower and middle income country (LMIC), achieved great leap in development in last two decades(¹). However, health and social wellbeing of its people continued to remain as a problem. Burgeoning population in every decade since independence has resulted in consistent increase in demand for quality health services (²). Despite, introduction of health initiatives by the government, the flared economic, regional and gender disparities are posturing challenges for the health sector (³). The percentage of rural population (% of total population) in India was reported at 66.46 % in 2017, according to the World Bank(⁴). The underlined fact about 75% of health infrastructure, clinical man power and other health resources is concentrated in urban areas where 27% of the population resides depicts uneven healthcare scenario(⁴). There is evidence of infectious and waterborne diseases such as diarrhoea, amoebiasis, typhoid, infectious hepatitis, worm infestations, measles, malaria, tuberculosis, whooping cough, respiratory infections, pneumonia and reproductive tract infections dominating the morbidity pattern in rural areas (⁵). Non Communicable Diseases (NCD) underwent a significant shift in last decade. A study on the causes of mortality in rural India reported to be 47% of all deaths due to NCDs while communicable, maternal, peri-natal and nutritional conditions together accounted for 30%, indicating that NCDs have should be a healthcare priority⁶. The pattern of NCDs in rural India reflects similarly to that in urban India. High blood pressure, the biggest risk factor for death worldwide, now has the prevalence of 14% in rural India, while diabetes affects about 15% in adults⁷. Diseases such as cancer, blindness, mental illness, hypertension, diabetes,
HIV/AIDS, accidents and injuries are also on the rise. The health status of rural India is reflected in the life expectancy (66.7 years), infant mortality rate (34/1000 live births), maternal mortality rate (130/100 000 live births). Women and children specifically from lower socio economic class are the most vulnerable population. Rural health need to be addressed both at macro (national and state) and micro (district and regional) levels. A holistic approach embedded with genuine effort to bring the poorest of the population to the centre of the fiscal policies is essential. The research gap in this area led to explore the predominant diseases in the rural area of Mulshi Taluk/Block of District Pune in Maharashtra with the objective. To explore the pattern of diseases and possible causes among different age groups of the rural population.

Method

The study used qualitative methods. Symbiosis Community Outreach Program and Extension (SCOPE) an initiative of Symbiosis International University implements health care services in 21 villages, the study area is one of them in the Mulshi block of district Pune. In depth interviews with 9 physicians in private practice, ASHA were administered. An open ended guideline was used. It contained questions on the number of prevalent illnesses in the community; factors contributing to it, possible course of treatment and recommendations to improve the health of the people. Written informed consent was taken from the respondents. The data collection was done in the month of January 2017. The content from the interviews were transcribed and translated in English. It was analysed by inductive approach.

Results

Table 1 shows respondents in the age group 28-42 years as reported. They reported that they charge Rs. 100-200 for each consultation, dispense two days medicines and write prescriptions, if required.

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Qualification</th>
<th>Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID 1</td>
<td>35 Male</td>
<td>BAMS</td>
<td>7</td>
</tr>
<tr>
<td>ID 2</td>
<td>32 Male</td>
<td>BAMS</td>
<td>3</td>
</tr>
<tr>
<td>ID 3</td>
<td>42 Male</td>
<td>BAMS</td>
<td>17</td>
</tr>
<tr>
<td>ID 4</td>
<td>30 Male</td>
<td>BAMS</td>
<td>10</td>
</tr>
<tr>
<td>ID 5</td>
<td>34 Male</td>
<td>BAMS</td>
<td>3</td>
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<tr>
<td>ID 6</td>
<td>29 Female</td>
<td>BHMS</td>
<td>1</td>
</tr>
<tr>
<td>ID 7</td>
<td>28 Female</td>
<td>BAMS</td>
<td>1</td>
</tr>
<tr>
<td>ID 8</td>
<td>36 Male</td>
<td>MBBS</td>
<td>1</td>
</tr>
<tr>
<td>ID 9</td>
<td>37 Male</td>
<td>BAMS</td>
<td>1</td>
</tr>
</tbody>
</table>

Profile of the village: The village has a total population of 4,862 peoples; (Males; 2575, Females; 2287, Children 0-6; 687). Village is under the primary health centre of Mutha. There is a sub centre and two private hospitals.

Table 2: Pattern of prevalent diseases found among villagers

<table>
<thead>
<tr>
<th>Name of the disease</th>
<th>Population</th>
<th>Probable reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>Adults 25-35 years</td>
<td>Unhealthy lifestyle</td>
</tr>
<tr>
<td>Diabetes mostly (Type 2)</td>
<td>Adults above 35 years</td>
<td>Heredity, Unhealthy lifestyle</td>
</tr>
<tr>
<td>Viral infections (Cough, Cold, Fever)</td>
<td>Children</td>
<td>Seasonal variations</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>Children (0-5 years)</td>
<td>Lack of awareness in mothers</td>
</tr>
<tr>
<td>Worm infestations</td>
<td>Children</td>
<td>Lack of sanitation and hygiene</td>
</tr>
<tr>
<td>Dengue/Malaria</td>
<td>All age groups</td>
<td>Lack of sanitation and hygiene</td>
</tr>
</tbody>
</table>

Findings from qualitative study

Increased prevalence of stress induced hypertension and Type 2 Diabetes among population.: Drastic change in lifestyle leads to high prevalence of high blood pressure and diabetes among elite class. Consumption of junk food, alcoholism, and smoking has become the norm of young generation. At the middle age men experiences stress due to issues in villages, no source of regular income, pressure to maintain high status, insecure living, issues related to children and spouses, marriages of daughter (need to pay high dowry) causes high blood pressure. There is a lack of routine screening;
it is diagnosed in emergency only. Often, adherence to treatment is poor, pattern of shift to different doctors is observed. Diabetes is also diagnosed in emergency. They are referred to specialists for further treatment or for complications associated to it. The doctors voiced out concern of underreporting of the symptoms and diagnosis of hypertension and diabetes. A doctor’s verbatim is self-explanatory; A villager said during screening of blood sugar check ‘I am happy now because we are unaware of the diagnosis, the result would bring tension, don’t want to take medicine regularly and does not want to restrict my lifestyle’.----ID 3

Children in the age group 0-5 years are vulnerable to Malnutrition: Children of labourers residing in temporary habitats at the construction sites are vulnerable to malnutrition. The story starts in the wombs of the mothers, migrants in search of work, they totally ignore the health during ANC. Other factors such as age, nutritional status and anaemia, spacing between two pregnancies contribute significantly. They resume working immediately after birth; therefore children are deprived of exclusive breast feeding and immunization. At anganwaadis, children’ growths are not monitored properly as per the growth charts. There is total lack of awareness among women about ANC. They don’t visit the doctors and does not take the iron and folic acid regularly.

Worm infestations in school children: The doctors revealed that parents of lower strata bring children to them complaining about nausea and vomiting. They have loss of appetite. Parasitic infections put a severe burden on the nutrition of the children living in poor sanitation. All of them unanimously underlined that scarcity of potable drinking water and low standards of personal hygiene (inadequate hand washing) add to rapid spread of these infections. Literacy status of mothers is the risk factor for worm infestation in children. Treatment of anti-parasitic medicine is given. Maintenance of hygiene that would definitely prevent further growth of worms. Hygiene complemented with medication will expedite recovery. They spoke about free anti parasitic medications for in schools but doubted its implementation.

Health problems of women

Prevalence of anaemia: Pregnant women often come with low levels of haemoglobin. They are underweight due to lack of intake of nutrition, reluctance to take iron and folic acid medicines due to the myth that head of baby would become large that could led to caesarean delivery. Mostly these women are into hard work till the last trimester. Lot of cases with iron deficiency anaemia, severe deficiencies of Vitamin B12 and folate are observed. Some need to be hospitalized during pregnancy. The poor health increase risk of serious complications including preterm delivery.

Dysmenorrhea in adolescent: Complains of lower stomach pain during menstruation for which the young girls come to us.

Vector borne diseases: Malaria and dengue cases are rampant during monsoon season common in all the age groups. Patients are admitted in hospitals. The treatment becomes expensive if they have to be treated in hospitals.

Resource constrain as expressed by ASHA worker: Scarcity of potable water is due to insufficient and irregular water supply. Some parts in the villages does not have water pipelines, they are dependent on water tankers. A few have their private bore wells. Grampanchayat distributes mediclor but it is not sufficient, villagers buy from shops. Each house in the village is attached with a toilet, but due to lack of water not able to maintain them. A van collects the garbage from all the streets, houses and dumps it on a big open land where it is processed. People from the villages do not segregate dry and wet garbage. She believes that maintenance of proper hygiene and availability of potable drinking water will keep away many diseases.

Discussion

The finding about high blood pressure is supported by the systemic reviews of the pooled epidemiological studies of India that reflects total prevalence of 29.8%, whereas it was 33.8% in urban areas and 27.6% in rural areas of India. The prevalence is increasing fast in rural areas owing to changes in food habits, sedentary life style and use of tobacco 12. A study of multilevel modelling using data of District Level Household & Facility Survey (DLHS-4), 2012–13 showed a prevalence of 24% in rural parts of Maharashtra 13. Screening, early detection and treatment initiation is the strategy that would decrease the morbidity and mortality associated with hypertension 12. In India, the epidemic of diabetes continue to increase and is experiencing a shift in prevalence from urban to rural areas, the affluent to the less privileged and from older to younger people. A review of studies in rural
India conducted found that prevalence increased from 1.9% in 1994 to upwards of 12% in 2009. In addition, rural prevalence rates of impaired glucose tolerance (IGT, a form of pre-diabetes) range from 5.5% to 7.2%. Figures are concerning, considering 72.2% of the Indian population live in rural areas characterized by poverty, isolation, and poor access to health services (10).

The National Family Health Survey reports 34% of children under five years old, representing that they had been chronically undernourished, 26% wasted due to recent inadequate food intake or an illness causing weight loss. Age of the child, number of family members and child’s prior history of illness are the elements having influence on the nutritional status of children (15). Review highlights that early childhood malnutrition is fundamentally linked to poverty and food insecurity (15). High prevalence of worm infestation leads to malnutrition, which was reported in this study. Research shows an overall prevalence in the range of 11.3%-90% in India. It was reported to be > 30% in Maharashtra and Tamil Nadu (16). The impure drinking water, low socioeconomic state, poor sanitation coupled with low literacy rates of parents particularly the mothers are the main causes (17). Diarrhoea, abdominal pain and low haemoglobin levels as the immediate outcome of infections, long term effects of these infections show reduced cognitive abilities, intellectual capacity and lower work productivity (17).

NFHS quote’s prevalence of 50% among pregnant women (9,10). Dysmenorrhea in adolescents was found to be prevalent in rural than urban girls, associated with their BMI. Improving nutritional status of the girls may reduce the dysmenorrhea (19). The prevalence of dysmenorrheoa is 54% (53% in girls in urban areas and 56% in girls in rural areas) in rural region of Hyderabad. In Amravati, it was found to be around 60%. Girls in rural areas resort to physical labour and other natural methods to obtain relief while the girls in urban areas are mainly depending on medications (20).

According to the World Malaria Report 2017, in the year 2016, more than half of the population (698 million) was at risk of malaria. India accounted for 6% of all malaria cases in the world, 6% of the deaths, and 51% of the global P. vivax cases. The biggest burden of malaria in India is borne by the most backward, poor and remote parts of the country, with >90-95% cases reported from rural areas and <5-10% from urban areas; however, the low malaria incidence in urban areas may be due to almost non-existing surveillance (21). Dengue has been endemic in 16 states since the beginning; the number has shown a steady rise with every passing year, the mortality has reduced. The overall mortality rate of 1.2% in 2007 dropped to 0.25% in 2013 (22). The finding about scarcity of water, lack of sanitation and hygiene facilitates mosquito breeding places that are hazardous and lead to increase in the number of cases of Malaria and Dengue.

Conclusion

This particular study attempted exploration of the diseases that determined health status of the population in one of the village located in the Mulshi block/taluk, district Pune, Maharashtra. The findings cannot be generalized as it has emerged primarily from interviews with physicians in private practice only. A representative survey to identify absolute prevalence of diseases is recommended in future. Presently comprehensive health education sessions for different age groups, organizations of screening camps for early detection of cases of hypertension and diabetes, collaboration with government health programs and facilities to ensure efficient implementation of the ongoing program is recommended.

Conflict of Interest: The author declares no conflict of interest.

Source of Funding: No source of funding.

Ethical Clearance: The study is on program data

REFERENCES

1. The World Bank, World Bank In India, Source www.worldbank.org


Varying Patterns of Societal Discriminations in Anaemia among Women in India: Findings from Third and Fourth Rounds of NFHS Survey

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ABSTRACT

Introduction: In a society where the status of women is poor, women face both hidden and open discrimination within family. India has always been a country with a high prevalence of anaemia. Iron deficiency anaemia (IDA) is the most common nutritional deficiency in pregnant women.

Objectives: To investigate the patterns of societal differences in anaemia among women of reproductive age in India.

Method: Cross-sectional surveyed data, which was nationally representative from the 2005/2006 and 2015/2016 National Family Health Surveys of India. Multivariable logistic regression models and relative risk were used to assess trends and social inequalities in anaemia. Anaemia status defined by haemoglobin level (<12 g/dl in non-pregnant women, haemoglobin<11 g/dl for pregnant women).

Results: Over the 10-year period, anaemia prevalence decreased significantly from 56.1% (95% CI 55.4% to 56.8%) to 53.1% (95% CI 52.9% to 53.3%) among Indian women.

Conclusions: The significant state variation was marked in prevalence of anaemia. In two subsequent surveyed data, anaemia was positively associated with lower wealth status, lower education and belonging to scheduled tribes and scheduled castes.

Keywords: Anaemia, NFHS, Wealth index, Caste, Education.

Introduction

Anaemia continues to be a major public health problem worldwide, particularly among females of reproductive age in developing country settings. In India, prevalence ranges between 33-89 percent. The rural women were suffering higher prevalence of anaemia compared to urban women, particularly among the lower income groups, and that women with low body mass index (BMI; <18.5 kg/m2). Pattern of variations were observed for the prevalence and determinants of blood haemoglobin level in different anaemic categories like; mild, moderate, and severe anaemic mother. Anaemia among India’s women during this recent period is a matter of concern, and in contrast, women’s health and nutritional status. While socioeconomic inequalities in anaemia continue a matter of concern over a period of time. Economic status of families, especially poor families, is a prerequisite to the improvement of anaemia among adolescent girls and the level of education is also a major factor. Anaemia continues to be a significant public health concern in India in women, across the lifespan. Between 2006 and 2016, improvement was slow. There was a moderate decline in anaemia prevalence among pregnant women and lactating women. However, there was nearly no decline in anaemia prevalence among adolescents, women of reproductive age.
Therefore, we set out to examine the national and state trends in anaemia prevalence and examine how societal discriminations in anaemia among women of reproductive age have changed over time during a recent 10-year period. In view of several literature review, there were various societal discrimination reflected nationally, state as well as community level. In this context, literature review framed the research question like, is there any discrimination on pattern of anaemia in India and its states. What are the causes among reproductive age of women in Indian society, those are affected with anaemia? Is increasing or decreasing?

Objective

The specific objectives of the study are to

1. To investigate the pattern of societal differences in anaemia among women of reproductive age in two subsequent survey of India.

2. To investigate the state wise pattern of anaemia in two subsequent survey.

Method

We used data from the National Family Health Survey (NFHS) of India carried out in 2005/2006 (NFHS-3) and 2015/2016 (NFHS-4). These nationally representative cross-sectional surveys collect detailed information relating to population, health and nutrition. The surveys use a stratified cluster multistage sampling design, with generally two stages in rural areas and three stages in urban areas. In brief, in rural areas, in the first stage, primary sampling units (PSU) are selected using a probability proportional to population size; in the second stage, households are systematically selected for inclusion in the survey. In urban areas, in the first stage, wards are selected using a probability proportional to population size; in the second stage, a census enumeration block is selected randomly from each ward; and in the third stage, households are selected randomly from each census enumeration block for inclusion in the survey. More details of the sampling methodology are described elsewhere, NFHS-3 and NFHS-4 included all women aged 15–49 years. Both surveys were carried out by trained fieldworkers using standardized questionnaires and methodologies, and the household response rate was greater than 95% in both surveys.

Dependent Variable: Anaemia level was considered as outcome variable, which was categorized dichotomously for analysis purpose, any type of anaemic women and moderate/severe level anaemic women.

Independent Variables: The demographic, socioeconomic, cultural and behavioral variables included in the analysis with its categories were Age (years): 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49; Marital status: Currently married, Formerly married; Parity: 0, 1, 2, 3, 4, 5+; Religion: Hindu, Muslim, Christian, Sikh, Buddhist, Other/missing; Caste: SC, ST, OBC, General, Other/missing; Employment: Not working, Non manual, Agriculture, Manual; Residence: Rural, Urban; Wealth: Poorest, Poorer, Middle, Richer, Richest; Education (years): None, 1–5, 6–10, 11–12, ≥13; BMI: Underweight, Normal, Overweight, Obese; Contraceptive use: Not using, CP, IUD, Female sterilization, Other; Vegetarian: No, Yes; Alcohol: No, Yes; based on a review of the existing literature.

Statistical Analysis

Multivariable logistic regression analysis and relative risk used with 95% confidence interval to identified relative changes from NFHS-3 to NFHS-4.

Results and Discussions

The weighted distribution of anaemia level and non anaemic women through different predictors. The fourth round of national family health survey identified at national level severe anaemic women was 7060 (1.0%), moderate level was 84299 (12.4%), mild level was 269332 (39.6%) and not anaemic women was 318755 (46.9%). Next, we examined the changes in the prevalence of anaemia (table 1). Any type of anaemic women were identified 45238 (56.1%) from NFHS-3 (2005/2006) and it’s declined in next round survey NFHS-4 (2015/2016), which was 360692 (53.1%). In sequence, moderate and severe anaemic women were reported 13298 (17.2%) from NFHS-3 and 91360 (13.4%) from NFHS-4. Accordingly, prevalence was reported in table 2 with different predictor variables.

We found marked regional variation in anaemia prevalence, which was in NFHS-3 (56.1%; 95% CI: 55.4 to 56.8) and NFHS-4 (53.1%; 95% CI: 52.9 to 53.3) with relative risk (RR = 0.95 and 95% CI: 0.94 to 0.95) in India. There was a significant increase in the relative risk of anaemia over time. In the states wise prevalence varies across the states in subsequent survey and for.
other states, which was mentioned in (table 2), information not available for NFHS-3. Most of the states and its relative prevalence of anaemia varies over this 10-year period. Table 3 shows the adjusted multivariable logistic regression analysis for two subsequent survey. In view of wealth index of women, richer, middle, poorer and poorest were significantly more likely to have any anaemia in comparison to richest from both survey NFHS-3 and NFHS-4. Education; uneducated, 1 to 5 years educated and 6 to 10 years educated were significantly more likely to have any anaemia in comparison to greater than equal to 13 year education, respectively. Caste; Schedule caste (SC) and schedule tribe (ST) were significantly more likely to have any anaemic in comparison to general caste.

Table 1: Descriptive characteristics of any anaemia and moderate/severe anaemia prevalence among ever-married women aged 15–49 years from the 2005/2006 and 2015-16 NFHS surveys

<table>
<thead>
<tr>
<th>Women aged 15-49</th>
<th>Any anaemia</th>
<th>Moderate/severe anaemia</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>2005</td>
<td>2015</td>
</tr>
<tr>
<td>Overall</td>
<td>85403</td>
<td>699686</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–19</td>
<td>4541</td>
<td>121552</td>
</tr>
<tr>
<td>20–24</td>
<td>13570</td>
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<tr>
<td>25–29</td>
<td>16604</td>
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</tr>
<tr>
<td>30–34</td>
<td>15593</td>
<td>96769</td>
</tr>
<tr>
<td>35–39</td>
<td>14492</td>
<td>90890</td>
</tr>
<tr>
<td>40–44</td>
<td>11736</td>
<td>77969</td>
</tr>
<tr>
<td>45–49</td>
<td>8867</td>
<td>74497</td>
</tr>
<tr>
<td>Marital status</td>
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<td></td>
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<td>29279</td>
</tr>
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<tr>
<td>0</td>
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</tr>
<tr>
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<td>13627</td>
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</tr>
<tr>
<td>2</td>
<td>22459</td>
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</tr>
<tr>
<td>3</td>
<td>17135</td>
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</tr>
<tr>
<td>4</td>
<td>10546</td>
<td>53637</td>
</tr>
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<td>5+</td>
<td>13264</td>
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<tr>
<td>Muslim</td>
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<td>96461</td>
</tr>
<tr>
<td>Christian</td>
<td>4992</td>
<td>16620</td>
</tr>
<tr>
<td>Sikh</td>
<td>1969</td>
<td>11618</td>
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<tr>
<td>Buddhist</td>
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<td>6469</td>
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<tr>
<td>Other/missing</td>
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<td>Caste</td>
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<td></td>
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<tr>
<td>SC</td>
<td>14720</td>
<td>142619</td>
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<td>ST</td>
<td>9716</td>
<td>64144</td>
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<td>OBC</td>
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<td>31312</td>
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<th>NFHS-4</th>
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<td>9921</td>
<td>4365</td>
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<td>17717</td>
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<td>Manual</td>
<td>7881</td>
<td>7592</td>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5 Richest</th>
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<td>17998</td>
<td>16493</td>
<td>15684</td>
<td>15559</td>
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<td>1st poorest</td>
<td>124054</td>
<td>136900</td>
<td>143814</td>
<td>147978</td>
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<td>2nd poorest</td>
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<td>10156</td>
<td>8502</td>
<td>12841</td>
<td>7601</td>
</tr>
<tr>
<td>3rd poorest</td>
<td>71502</td>
<td>74124</td>
<td>74852</td>
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<td>72965</td>
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<td>4th poorest</td>
<td>4006</td>
<td>3163</td>
<td>2486</td>
<td>2043</td>
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<td>Richest</td>
<td>18759</td>
<td>19127</td>
<td>19940</td>
<td>18553</td>
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<table>
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<th>6–10</th>
<th>11–12</th>
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<td>25443</td>
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<td>86290</td>
<td>246906</td>
<td>84131</td>
<td>89281</td>
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<td>IUD</td>
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<td>6221</td>
<td>2199</td>
<td>3697</td>
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<th>Overweight</th>
<th>Obese</th>
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<td>414397</td>
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<td>7899</td>
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<tr>
<td>Yes</td>
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<p>| Table 2: Weighted anaemia prevalence by state, and relative risk in anaemia prevalence over time |
|-----------------------------------------------|-----------------------------------------------|</p>
<table>
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<tr>
<th>Indian States</th>
<th>NFHS-3</th>
<th>NFHS-4</th>
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<td>95% CI</td>
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<td>360692</td>
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<td>55.4 to 56.8</td>
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<td></td>
<td></td>
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<td></td>
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<td>Delhi</td>
<td>1819</td>
<td>4556</td>
<td>43.2</td>
<td>40.1 to 46.3</td>
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<td>Haryana</td>
<td>2190</td>
<td>9610</td>
<td>56.5</td>
<td>54.0 to 59.0</td>
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<table>
<thead>
<tr>
<th>State</th>
<th>Total</th>
<th>Female</th>
<th>Range</th>
<th>Male</th>
<th>Range</th>
<th>Sex Ratio</th>
<th>Turnout</th>
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<td>Himachal Pradesh</td>
<td>2260</td>
<td>2003</td>
<td>42.8</td>
<td>53.5</td>
<td>51.3 to 55.7</td>
<td>1.25</td>
<td>1.19 to 1.31</td>
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<tr>
<td>Jammu &amp; Kashmir</td>
<td>1976</td>
<td>3309</td>
<td>53.6</td>
<td>50.4</td>
<td>56.8</td>
<td>49.5</td>
<td>47.8 to 51.2</td>
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<td>Punjab</td>
<td>2633</td>
<td>8076</td>
<td>38.4</td>
<td>36.0</td>
<td>40.8</td>
<td>53.5</td>
<td>52.4 to 54.6</td>
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<td>Rajasthan</td>
<td>3156</td>
<td>16927</td>
<td>53.7</td>
<td>50.6</td>
<td>56.8</td>
<td>46.8</td>
<td>46.0 to 47.6</td>
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<td></td>
<td></td>
<td></td>
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<td>Madhya Pradesh(C)</td>
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<td>22591</td>
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<td>59.7</td>
<td>52.5</td>
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<td>54412</td>
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<td>49.2</td>
<td>52.7</td>
<td>52.4</td>
<td>52.0 to 52.8</td>
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<tr>
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<td>7715</td>
<td>69.4</td>
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<td>44.9 to 47.1</td>
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<td>321</td>
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<td>36.9</td>
<td>41.9</td>
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<td>43.6</td>
<td>53.7</td>
<td>56.2</td>
<td>52.9 to 59.5</td>
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<td>141</td>
<td>40.2</td>
<td>35.6</td>
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<td>17.7 to 31.9</td>
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<td>Sikkim</td>
<td>1378</td>
<td>111</td>
<td>58</td>
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<td>34.9</td>
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<tr>
<td>Tripura</td>
<td>1414</td>
<td>1143</td>
<td>67.5</td>
<td>64.4</td>
<td>70.6</td>
<td>54.5</td>
<td>51.6 to 57.4</td>
</tr>
<tr>
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<td></td>
<td></td>
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<td>268</td>
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<td>51.0</td>
<td>48.0</td>
<td>47.4 to 48.6</td>
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<td>16725</td>
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<td>65.0</td>
<td>60.0</td>
<td>59.3 to 60.7</td>
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<td>15208</td>
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<td>54.0</td>
<td>44.8</td>
<td>44.0 to 45.6</td>
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<tr>
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<td>2690</td>
<td>6506</td>
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<td>30.0</td>
<td>35.5</td>
<td>34.3</td>
<td>33.1 to 35.5</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>4440</td>
<td>28160</td>
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<td>51.1</td>
<td>56.3</td>
<td>55.0</td>
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<tr>
<td>Others*</td>
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<td></td>
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<td>Andaman and Nicobar Islands</td>
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<td>151</td>
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<td>NA</td>
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<td>58.1 to 73.3</td>
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</tr>
<tr>
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<td>NA</td>
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<td>71.7 to 80.3</td>
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<td>7676</td>
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<td>NA</td>
<td>47.0</td>
<td>45.9 to 48.1</td>
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<td>Dadra &amp;Nagar Haveli</td>
<td>NA</td>
<td>141</td>
<td>NA</td>
<td>NA</td>
<td>79.7</td>
<td>73.1 to 86.3</td>
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<td>NA</td>
<td>NA</td>
<td>59.0</td>
<td>45.2 to 72.8</td>
<td>NA</td>
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<tr>
<td>Jharkhand</td>
<td>NA</td>
<td>11230</td>
<td>NA</td>
<td>NA</td>
<td>65.2</td>
<td>64.3 to 66.1</td>
<td>NA</td>
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<td>Lakshadweep</td>
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<td>20</td>
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<td>NA</td>
<td>46.5</td>
<td>24.6 to 68.4</td>
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<tr>
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<td>NA</td>
<td>NA</td>
<td>27.9</td>
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<td>NA</td>
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<tr>
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<td>NA</td>
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<tr>
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<td>2615</td>
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<td>NA</td>
<td>45.1</td>
<td>43.2 to 47.0</td>
<td>NA</td>
</tr>
<tr>
<td>Telangana</td>
<td>NA</td>
<td>11248</td>
<td>NA</td>
<td>NA</td>
<td>56.6</td>
<td>55.7 to 57.5</td>
<td>NA</td>
</tr>
</tbody>
</table>

NA = information not available.

Table 3: Adjusted socioeconomic correlates of anaemia among ever-married women aged 15–49 years in 2005/2006 and 2015/2016

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted (OR)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Wealth index</td>
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</tr>
<tr>
<td>Richest</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Richer</td>
<td>1.05** (1.02 to 1.08)</td>
<td>1.32* (1.29 to 1.34)</td>
</tr>
<tr>
<td>Middle</td>
<td>1.06** (1.03 to 1.09)</td>
<td>1.18* (1.17 to 1.20)</td>
</tr>
<tr>
<td>Poorer</td>
<td>1.09** (1.06 to 1.13)</td>
<td>1.13* (1.12 to 1.15)</td>
</tr>
<tr>
<td>Poorest</td>
<td>1.14** (1.10 to 1.18)</td>
<td>1.07* (1.05 to 1.08)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥13</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11–12</td>
<td>1.01 (0.97 to 1.05)</td>
<td>1.19* (1.17 to 1.21)</td>
</tr>
<tr>
<td>6–10</td>
<td>1.06** (1.02 to 1.10)</td>
<td>1.61* (1.14 to 1.19)</td>
</tr>
<tr>
<td>1–5</td>
<td>1.06** (1.03 to 1.11)</td>
<td>1.12* (1.10 to 1.14)</td>
</tr>
<tr>
<td>None</td>
<td>1.06** (1.03 to 1.11)</td>
<td>1.09* (1.06 to 1.10)</td>
</tr>
<tr>
<td>Caste</td>
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<td></td>
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<tr>
<td>General</td>
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<td>1</td>
</tr>
<tr>
<td>SC</td>
<td>1.03* (1.00 to 1.05)</td>
<td>1.17* (1.16 to 1.19)</td>
</tr>
<tr>
<td>ST</td>
<td>1.13** (1.10 to 1.17)</td>
<td>1.32* (1.29 to 1.35)</td>
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<tr>
<td>OBC</td>
<td>1.00* (0.98 to 1.02)</td>
<td>1.05* (1.04 to 1.06)</td>
</tr>
<tr>
<td>Other/missing</td>
<td>0.98 (0.94 to 1.02)</td>
<td>0.99 (0.97 to 1.02)</td>
</tr>
</tbody>
</table>

**Conclusion**

In this study, the prevalence of anaemia among women of reproductive age has slightly decreased significantly during a recent 10-year period in India. Majority of regional variations were identified. Maximum prevalence of anaemic inflation was seeming across socio-economic groups and states in comparison to third round of national family health survey. There was geographical variation in anaemia trends. Education, wealth index and castes were identified measure causal factors of anaemia among reproductive age group of women.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance:** The unit level data from NFHS-3 and NFHS-4 is available in the public domain.

**REFERENCES**


Evaluation of Fentanyl and Dexmedetomidine as Additive to Ropivacaine for Epidural Anesthesia in Surgeries below T

Level

Purnendu, Soumita Kar

Associate Professor and In-charge SCHS, SCHS, Symbiosis, Pune, Graded Specialist (Anesthesia), Military Hospital, Ramgarh, Jharkhand

ABSTRACT

Introduction: Epidural anesthesia is commonly practiced for providing intra-operative surgical anesthesia. Ropivacaine is increasingly being used as an epidural agent as it has less cardiac toxicity than bupivacaine. Additives are being combined with local anesthetics to improve the quality of blockade and to accelerate the onset of blockade. This study was undertaken to compare the efficacy of fentanyl and dexmedetomidine as additive to ropivacaine for the onset, duration, and quality of epidural anesthesia in surgeries below T₁₀ level.

Objectives: To evaluate the anesthetic effects of ropivacaine, ropivacaine with fentanyl, and ropivacaine with dexmedetomidine for epidural anesthesia in surgeries below T₁₀ level.

Novelty/Originality: Lower doses of drug fentanyl and dexmedetomidine with ropivacaine have not been evaluated to achieve anesthetic effect.

Material and Method: After ethical committee clearance, 75 patients undergoing surgeries below T₁₀ level under epidural anesthesia, divided randomly into three groups - Group 1: (R,25): received 18ml of 0.5% ropivacaine; Group 2: (RF,25): received 18ml of 0.5% ropivacaine with 20mcg fentanyl; Group 3: (RD,25): received 18ml of 0.5% ropivacaine with 10mcg dexmedetomidine, into epidural space. The appropriate statistical technique will be applied on dataset.

Results and Discussion: The demographics and ASA grade were similar in all groups. The mean time for onset of sensory block in group R was 18.64 ± 4.41, 12.84 ± 1.84 minute in RF group and 10.76 ± 2.73 minute in RD group. The mean time of onset of motor block in group R was 24.55 ± 5.54 minute, 17.8 ± 2.53 minute in group RF and 14.8 ± 3.32 minute in RD group. The mean duration of sensory analgesia in R group was 139.77 ± 21.41 minute, in RF group was 243 ± 29.69 minute, while in RD group was 312.4 ± 30.21 minute. State of analgesia was uniform in 84% cases, partial in 4% cases and failed in 12% cases in group R but in RF and RD groups, there was no failed or partial state of analgesia. So, in RF and RD groups, state of analgesia was uniform in all 50 patients.

Application: Improved patient safety as ropivacaine is reported to be less cardio toxic.

Conclusion: Both Fentanyl and dexmedetomidine as additive to ropivacaine can provide epidural anesthesia. Epidural anesthesia achieved with dexmedetomidine is more effective than fentanyl as an additive to ropivacaine alone and duration and intensity of analgesia is also more that due to fentanyl.

Keywords: Epidural anesthesia, Ropivacaine, Fentanyl, Dexmedetomidine.
is added for better analgesia and it also decreases the requirement of higher concentration of local anesthetics, thus reduces the systemic toxicity and motor block.[2] Dexmedetomidine, an alpha adrenoceptor agonist with alpha-2 selectivity[3] acts on alpha adrenoceptor located in the spinal cord. This study was undertaken to evaluate and compare additive effect of fentanyl and dexmedetomidine to ropivacaine for epidural anaesthesia.

Materials and Method

The study was conducted after the ethical committee clearance and the written informed consent from the patients. Patients with physical status ASA grade I and II, between 18 to 60 years, both male and female patients undergoing surgeries below the level of T10 level were included in the study.

A total of 75 patients were randomly allocated into one of the three groups:

Group 1: (R,25): receiving 18ml of 0.5% ropivacaine for epidural anaesthesia

Group 2: (RF,25): receiving 18ml of 0.5% ropivacaine with 20mcg fentanyl for epidural anaesthesia

Group 3: (RD,25): receiving 18ml of 0.5% ropivacaine with 10mcg dexmedetomidine for epidural anaesthesia

Patients were pre-medicated with 0.25 mg of alprazolam at bedtime on pre-operative night. Good intravenous access was secured with 18G intravenous cannula. The patients were preloaded with 15 ml/kg of ringer’s lactate solution. All monitors were attached to monitor ECG, heart rate, blood pressure and SpO2. Then patients were administered epidural block in sitting position with 16G Touhy needle through L2-L3 inter-vertebral space. Epidural catheter was inserted and secured 3-5 cm into the epidural space. Confirmation for correct placement of the catheter was done by injecting epidural test dose of 3 ml of 2% lignocaine hydrochloride with adrenaline 1:200000 and then the patients were placed in supine position. After a negative response to the test dose was confirmed, the study solutions were administered randomly after aspiration from the catheter to confirm that catheter is correctly placed. Surgical positions of the patients were made after adequate anaesthesia.

The following were assessed:

1. Onset of sensory blockade at T10 level noted by painful stimuli by pinprick.
2. Maximum level of sensory blockade
3. Time to reach the maximum sensory blockade
4. Time to complete motor blockade was noted.

Level of motor blockade were scored on modified Bromage scale.

At the end of study, all the data were compiled systematically and analyzed using IBM® SPSS® Statistics 20 statistical software package, Chi-square tests were applied for categorical variables, and continuous variables were compared using one-way ANOVA test. Data are expressed in terms of mean ± standard deviation (SD). P value was reported at the 95% confidence interval, and value of $P < 0.05$ was considered significant and $P < 0.0001$ as highly significant.

Sample size was calculated based on literature search for variation in studied data. The sample size was calculated using effect size of 5 and SD of 6 with alpha error at 5% and power at 80%. Required sample size was 22 per group but 25 patients per group were included in the study.

Results

The demographic profile, sex, and ASA grade of the three groups were comparable (p value > 0.05).

Table I: Onset of sensory block, time to reach maximum sensory and motor block

<table>
<thead>
<tr>
<th></th>
<th>Drug Group</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group R</td>
<td>Group RF</td>
</tr>
<tr>
<td>Onset of sensory block in minute</td>
<td>18.64 ± 4.41</td>
<td>12.84 ± 1.84</td>
</tr>
<tr>
<td>Time to max sensory block (min)</td>
<td>24.55 ± 5.54</td>
<td>17.8 ± 2.53</td>
</tr>
<tr>
<td>Time to Max motor block</td>
<td>31.67 ± 4.33</td>
<td>24.8 ± 4.67</td>
</tr>
</tbody>
</table>
The mean onset time of sensory analgesia up to T10 level was 18.64 ± 4.41 minute in group R, 12.84 ± 1.84 minute in group RF and 10.76 ± 2.73 minute in group RD. The p values between group R & RF and R & RD were highly significant (p value < 0.001) and p value between RF & RD was significant (p value < 0.05). So, the onset of sensory analgesia was earlier in RD and RF group in comparison to R group; and in RD group it was earlier than RF group also. The mean time to reach the maximum sensory block in group R was 24.55 ± 5.54 minute, 17.80 ± 2.53 minute in group RF, and 14.80 ± 3.32 minute in group RD. The p values between group R & RF and R & RD were highly significant (p value < 0.001) and p value between RF & RD was significant (p value < 0.05). The mean time to complete maximum motor block was 31.67 ± 4.33 minute in group R, 24.80 ± 4.67 minute in group RF, 17.04 ± 3.67 minute in group RD. The p value between group R & RF was significant (p value < 0.05). The p values between group R & RD and RF & RD were highly significant (p value < 0.001). So, the time taken to complete maximum motor block was significantly earlier in RD group in compare to R and RF groups.

### Table II: Comparison of maximum sensory level and motor block

<table>
<thead>
<tr>
<th>Drug Group</th>
<th>Max sensory level (thoracic)</th>
<th>p value</th>
<th>Group (R vs RF)</th>
<th>Group (R vs RD)</th>
<th>Group (RF vs RD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>RF</td>
<td>RD</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2(9.1)</td>
<td>8(32)</td>
<td>10(40)</td>
<td>20(27.8)</td>
<td>0.083</td>
</tr>
<tr>
<td>5</td>
<td>8(36.4)</td>
<td>10(40)</td>
<td>10(40)</td>
<td>28(38.9)</td>
<td>0.016</td>
</tr>
<tr>
<td>6</td>
<td>12(54.5)</td>
<td>7(28)</td>
<td>5(20)</td>
<td>24(33.3)</td>
<td>0.757</td>
</tr>
<tr>
<td>Total</td>
<td>22(100)</td>
<td>25(100)</td>
<td>25(100)</td>
<td>72(100)</td>
<td></td>
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</tbody>
</table>

Max motor block on Bromage scale

<table>
<thead>
<tr>
<th></th>
<th>Group (R vs RF)</th>
<th>Group (R vs RD)</th>
<th>Group (RF vs RD)</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td></td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>1</td>
<td>5(22.7)</td>
<td>0(0)</td>
<td>5(6.9)</td>
</tr>
<tr>
<td>2</td>
<td>4(18.2)</td>
<td>5(20)</td>
<td>9(12.5)</td>
</tr>
<tr>
<td>3</td>
<td>0(0)</td>
<td>20(80)</td>
<td>45(62.5)</td>
</tr>
<tr>
<td>Total</td>
<td>22(100)</td>
<td>25(100)</td>
<td>72(100)</td>
</tr>
</tbody>
</table>

The maximum sensory level achieved was more in RD group (40%), the p value between R & RF and RF & RD were not significant, but p value between R & RD was significant (p value < 0.05). So, in RD group it was significantly greater than R group. Maximum level of motor blockade was significantly greater in RF and RD group than R group; and also in RD group than RF group.

### Table III: Comparison of state of analgesia

<table>
<thead>
<tr>
<th>State of analgesia</th>
<th>Drug Group</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>RF</td>
</tr>
<tr>
<td>F</td>
<td>3(12)</td>
<td>0(0)</td>
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<tr>
<td>P</td>
<td>1(4)</td>
<td>0(0)</td>
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<tr>
<td>UF</td>
<td>21(84)</td>
<td>25(100)</td>
</tr>
<tr>
<td>Total</td>
<td>25(100)</td>
<td>25(100)</td>
</tr>
</tbody>
</table>

(F for failed; P for partial; UF for uniform anesthesia)

State of analgesia was uniform in 84% cases, failed in 12% and partial in rest 4% cases in group R, however in RF and RD groups, there was no failed or partial state of analgesia. So, in RF and RD groups, analgesia was uniform in all 25 patients.
Table IV: Monitoring of Mean Arterial Pressure, heart rate and SpO₂

<table>
<thead>
<tr>
<th>Drug Group (Gp)</th>
<th>p value</th>
<th>R</th>
<th>RF</th>
<th>RD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± Std. Deviation</td>
<td>Mean ± Std. Deviation</td>
<td>Mean ± Std. Deviation</td>
<td>Gp (R vs RF)</td>
<td>Gp (R vs RD)</td>
</tr>
<tr>
<td>MAP before analgesia</td>
<td>0.474</td>
<td>0.492</td>
<td>0.955</td>
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</tr>
<tr>
<td>MAP after 10 min</td>
<td>0.003</td>
<td>0.000</td>
<td>0.009</td>
<td></td>
</tr>
<tr>
<td>MAP after 45 min</td>
<td>0.564</td>
<td>0.035</td>
<td>0.074</td>
<td></td>
</tr>
<tr>
<td>HEART RATE before analgesia</td>
<td>0.663</td>
<td>0.227</td>
<td>0.381</td>
<td></td>
</tr>
<tr>
<td>HEART RATE after 10 min</td>
<td>0.923</td>
<td>0.003</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>HEART RATE after 45 min</td>
<td>0.001</td>
<td>0.191</td>
<td>0.020</td>
<td></td>
</tr>
<tr>
<td>SpO₂ before analgesia</td>
<td>1.000</td>
<td>1.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>SpO₂ after 10 min</td>
<td>0.066</td>
<td>0.861</td>
<td>0.079</td>
<td></td>
</tr>
<tr>
<td>SpO₂ after 45 min</td>
<td>0.114</td>
<td>0.105</td>
<td>0.879</td>
<td></td>
</tr>
</tbody>
</table>

The change in MAP after 10 minute was significant between group R and RF, and between group RF and RD. It was highly significant between group R and RD. Changes of mean heart rate after 10 minute were significant between group R and RD, and between group RF and RD. Mean SpO₂ in all the three groups were comparable, there was no significant difference in three groups.

Table V: Conversion rate to general anaesthesia (GA)

<table>
<thead>
<tr>
<th>Drug Group (Gp)</th>
<th>p value</th>
<th>Converted to GA</th>
<th>R</th>
<th>RF</th>
<th>RD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not converted to GA</td>
<td>0.074</td>
<td>72(96)</td>
<td>22(88)</td>
<td>25(100)</td>
<td>25(100)</td>
<td></td>
</tr>
<tr>
<td>Converted to GA</td>
<td>0.074</td>
<td>3(4)</td>
<td>0(0)</td>
<td>0(0)</td>
<td>0(0)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>NA</td>
<td>75(100)</td>
<td>25(100)</td>
<td>25(100)</td>
<td>25(100)</td>
<td></td>
</tr>
</tbody>
</table>

In group R, there was requirement of conversion to general anesthesia in 3 patients among 25 patients i.e. 12% cases; but no requirement in RF and RD groups. The p value was not significant among these three groups. So, there was no significant requirement of conversion to general anesthesia after epidural anesthesia in group R compared to group RF and RD (p value > 0.05).

Table VI: Complications

<table>
<thead>
<tr>
<th>Drug Group (Gp)</th>
<th>p value</th>
<th>R</th>
<th>RF</th>
<th>RD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea</td>
<td>0.684</td>
<td>0.384</td>
<td>0.637</td>
<td>9(12)</td>
<td>2(8)</td>
</tr>
<tr>
<td>Hypotension</td>
<td>0.312</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>13(17.3)</td>
<td>12(48)</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>NA</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>10(13.3)</td>
<td>10(40)</td>
</tr>
<tr>
<td>Pruritus</td>
<td>0.149</td>
<td>NA</td>
<td>0.149</td>
<td>2(2.7)</td>
<td>0(0)</td>
</tr>
<tr>
<td>Shivering</td>
<td>0.440</td>
<td>0.637</td>
<td>0.221</td>
<td>10(13.3)</td>
<td>10(40)</td>
</tr>
</tbody>
</table>

There was no significant change in the incidence of nausea among these three groups. Incidence of hypotension was 4% and 48% in RF and RD group respectively. Bradycardia occurred in 40% cases in group RD with the p value of <0.001 between R & RD and RF & RD group. Pruritus was observed in RF group (8%). Shivering occurred in 12%, 20% and 8% of cases in group R, RF and RD respectively.
Discussion

The synergism between epidural local anaesthetic agent and opioids is well established but synergism of local anaesthetic agent with dexmedetomidine in lower concentration through epidural route has not been evaluated. This study was undertaken to compare the synergistic effect of dexmedetomidine and fentanyl with ropivacaine in lower concentration through epidural route. Ropivacaine causes nerve block via reversible inhibition of sodium ion flux in nerve fibers. The efficacy of ropivacaine with its low propensity for motor block and reduced potential for central nervous system toxicity and cardio-vascular toxicity appear to be an important option for management of anesthesia. Dexmedetomidine is a new addition to α-2 agonist group of drugs which acts on both pre and post synaptic nerve terminal and central nervous system by decreasing the sympathetic out flow and norepinephrine release; causing sedative, anti-anxiety, analgesic, sympatholytic and hemodynamic effect. Dexmedetomidine does not cause opioid related side effect like respiratory depression, pruritus, nausea, and vomiting, but it may cause hypotension and bradycardia.

Dexmedetomidine has been used in dose of 1 μg/kg epidurally as an adjunct to local anesthetics in few studies. A pilot study was carried out at with addition of lower doses of dexmedetomidine ranging from 5 to 15 μg, as adjunct to ropivacaine intrathecally and epidurally, which showed acceptable quality and duration of analgesia with minimal side effects. Hence, addition of 10 μg dexmedetomidine was taken, to compare with 20 μg fentanyl, as an adjunct to 0.5% ropivacaine epidurally. In this study, the mean time for onset of sensory block and motor block was significantly shorter with both dexmedetomidine and fentanyl compared to ropivacaine alone. Furthermore, onset of both sensory and motor block was faster with addition of dexmedetomidine to ropivacaine compared to addition of fentanyl. These results were similar with the results of Bajwa SJ et al. They used higher concentration of ropivacaine 0.75%, fentanyl (1mcg/Kg) and dexmedetomidine (1mcg/Kg).

 Patients of R group attained sensory block up to T4 level, T5 level and T6 level in 9.1%, 36.4%, 54.5% respectively. Patient of RF group attained sensory block up to T4 level, T5 level and T6 level in 32%, 40% and 28% respectively. Patients of RD group attained sensory level of analgesia up to T6 in 20% cases, up to T5 in 40% and up to T4 level in rest 40% cases. Bajwa SJ & et al in their study found that maximum sensory block level was more in dexmedetomidine group. Degree of motor block was assessed by modified Bromage scale. In present study in group R, no patient achieved score 3, while 18.2% achieved score 2; 22.7% achieved score 1; and there was no muscle relaxation in 59.1% of cases. 80% of patients in RF group achieved motor block of score 3; and 20% achieved score 2; while all patients in RD group achieved motor block of score 3. The state of analgesia was intense in all patients in group RD and RF, while it was only in 84% of cases in group R; in 3 (12%) of cases it was converted to general anaesthesia and in 1 (4%) case it was supplemented with additional analgesia. Haemodynamic stability was one of the most remarkable features observed with addition of fentanyl to epidural ropivacaine in present study. None of the patient developed bradycardia in RF group, although 1 patient developed hypotension in this group. Negative chronotropic effect was exhibited by dexmedetomidine as 40% of patients developed bradycardia and 48% of patients developed hypotension in RD group. There was no hypotension or bradycardia in group R. Pruritus is a known side effect of opioids. It was present in 8% of cases in group RF and not in other groups. Incidence of side effect of nausea was present in 16% of patients in group R; 12% in group RF and 8% in RD, while there was no vomiting in any of the patients. In study of Bajwa SJ et al, the incidence of nausea and vomiting was 26% in group R, 14% in group RF and 4% group RD. This higher incidence of nausea and vomiting was reported in their study probably due to higher concentration of ropivacaine, fentanyl and dexmedetomidine. Shivering was present in 12%, 20% and 8% in group R, group RF and group RD respectively.

Conclusion

From this study it is concluded that Fentanyl and dexmedetomidine as additive to ropivacaine can provide epidural anaesthesia. Dexmedetomidine is more effective than fentanyl as additive. Dexmedetomidine may cause hypotension and bradycardia while fentanyl may cause pruritus.

Conflict of Interest: Nil

Source of Funding: Funded by command hospital (EC), Kolkata
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Enhancing Service Experience through Excellence in Patient Relationship (EPR) Training Programs

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ABSTRACT
Healthcare is a fundamental necessity for every human being, yet the quality of care and treatment offered to patients is abysmally low. The situation is an outcome of healthcare organizations failing to train their workforce on areas of service delivery to patients. This gap in patient service augments issues such as patient dissatisfaction, law suits against hospitals, reputation disaster and several others. This paper discusses the need for Excellence in Patient Relationship (EPR) program as a unique training intervention addressing patient care and relationship management. The program involves key personnel such as doctors, nurses, administrators who are responsible for addressing patient needs and ensuring service satisfaction.

Objectives:
1. Highlighting the need for training the hospital personnel to ensure patient service satisfaction
2. Promoting training in healthcare institutions to facilitate service excellence and foster relationship with patients

Novelty/Originality: The study draws its inspiration from a first-hand experience of conducting Excellence in Patient Relationship (EPR) programs across healthcare organizations pan India, comprising of doctors, nurses and other key hospital workforce.

Application (Benefit to the community/society):
1. The paper discusses the need to promote service excellence as a culture by healthcare professionals, thereby enhancing patient experience
2. Enrichment of healthcare services through training will positively impact the healthcare climate in the community, thereby benefiting the society at large

Conclusion: Healthcare service providers need to be trained not only on technical skills but also on behavioral areas that govern the quality of services being provided to patients.

Keywords: Healthcare, training, service excellence

Introduction
Healthcare is a fundamental right and the quality of healthcare extended to the masses is of prime importance. The past couple of decades have witnessed healthcare institutions such as hospitals, diagnostic centres and blood banks increasingly invest their resources in enhancing the service delivery standards extended to the patients. Training interventions aimed at upgrading the technical expertise of the medical staff including doctors, pathologists, nurses and other relevant personnel have been gaining prominence. At the same time, very few medical institutions are investing in training their workforce on areas of service delivery from a behavioral perspective. The current scenario in the Indian healthcare sector reveals that patients are not satisfied with the service standards maintained by hospitals. A report by (Sahay, 2008) (1) reveals that although the quality of

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medical care extended by the Indian healthcare sector is of a very high standard, the level of customer service extended to patients is abysmally low. This often results in complaints on account of patient waiting time, lack of patient care by the hospital staff, delays in patient discharge and other related issues. Issues such as delay at different stages of the patient’s stay in hospital add to the malaise of low service quality (Duggirala, Rajendran & Ananthraman, 2008) (2). It is quintessential for healthcare organizations to ensure that at each point of contact, all the employees exhibit patient care and are cognizant of the hospital’s reputation by ensuring that patients feel confident and safe during the hospitalization period (Gray & Boshoff, 2004) (3). A study conducted by (Tucker & Adams, 2001) (4) lends evidence to the fact that the patient’s perception of quality is governed by elements of care, apart from technical dimensions such as technical competence of the service provider. Although technical and functional trainings do have a positive impact on the core knowledge possessed by the hospital staff, the importance of tacit knowledge focusing on behavioral dimensions is equally critical and essential to the successful functioning of healthcare organizations.

**Literature Review**

Extensive research over the past few decades have focused on patient satisfaction in the healthcare domain (Linder-Pelz, 1982 (5); Cleary & McNeil, 1988 (6); Hall & Dorman, 1988 (7); Carr-Hill, 1992 (8); Koehler, Fottler & Swan, 1992 (9); Lewis, 1994 (10); Taylor & Cronin, 1994 (11); Bowers, Swan & Koehler, 1994 (12); Brennan, 1995 (13); Mummalaneni & Gopalakrishna, 1995 (14); Hall & Press, 1996 (15); Meredith & Wood, 1996 (16); Jackson & Kroenke, 1997 (17); Tucker, 1998 (18); Williams, Coyle & Healy, 1998 (19); Bolus & Pitts, 1999 (20); Jackson, Chamberlin & Kroenke, 2001 (21); Andaleeb, 2001 (22); Andaleeb, Siddiqui & Khandakar, 2007) (23). Earlier studies on service quality conducted by (Schmenner, 1986) (24) revealed the crucial aspects of quality evaluation such as:

- **Tangibles** (e.g. physical facilities, equipment, and appearance of personnel).
- **Responsiveness** (i.e. willingness or readiness of employees or professionals to provide service).
- **Recovery** (the degree to which service providers actively take corrective action when something goes wrong or something unexpected happens).
- **Knowledge** (knowledge and competence of service providers, possession of necessary skills, etc.).
- **Accessibility**: ease with which service providers can be reached and service consummated (e.g. location, opening hours, logistical issues such as car parking and facilities for people with disability).
- **Flexibility**: (ability to adjust operating systems and practices to deal with exigencies).

Healthcare professionals and clinicians opine that it is difficult to ascertain the quality of healthcare on account of the fact that the views of patients on service delivery are very subjective (Coulter, 2002) (25). Several studies in the domain of patient service satisfaction seem to suggest that satisfaction is more related to being an affective construct than a cognitive construct (Olsen, 2002) (26). In another study by (Lovelock, 2000) (27) it was identified that prior experiences held by people with regards to a particular service provider or competing service providers from the same industry, also tends to have an influence on the expectations they have about services. Researchers such as (Stoller, 2013) (28) have advocated that healthcare institutions should invest in conducting training programs for their leaders comprising of nurses, administrators and physicians, to enhance their effectiveness. Another study conducted by (Stoller, 2009) (29) observes that in comparison to clinical and/or academic skills, there is negligible focus on training physicians on leadership competencies.

The healthcare industry is characterized by hospitals that provide similar services; however they are still differentiated on the quality of service offered (Chaniotakis & Lymeropoulos, 2009) (30). Hence, service quality or SERVQUAL (Parasuraman, Zeithaml & Berry, 1985) (31) is an important parameter for healthcare organizations to evaluate their performance. In further research on service quality, (Parasuraman et al, 1988) (32) also presented a generic multi-item measure of service quality listing dimensions such as tangibility, reliability, responsiveness, assurance and empathy. Findings by researchers (Owusu-Frimpong, Nwankwo, Dason, 2010) (33) reveal that patients are inconvenienced by access-to-care issues and that healthcare providers need to focus on this area to improve the quality of service delivery and patient satisfaction. A study of hospital services conducted by (Otani & Kurz, 2004) (34) in the USA highlighted admission process, physician care, nursing care, compassion to family/friends,
pleasantness of surroundings and discharge process to be the key dimensions of service quality. The remedy to all the issues plaguing service in healthcare lies in effective and regular exposure to behavioral training interventions aimed at enhancing the service delivery standards in healthcare organizations.

**Excellence in Patient Relationship Program (EPR)**

**About EPR:** The Excellence in Patient Relationship Workshop is a unique workshop for healthcare organizations with the aim of disseminating essential skills to the workforce. This workshop delivers several benefits to the organization such as:

- Helping hospital staff to understand nuances of patient care.
- Enabling hospital staff including nurses and other support functions to deliver superior patient experience.
- Demonstrating pro-activeness and sense of ownership in building the hospital’s brand.

**EPR Program Methodology:** The program methodology was developed to simulate the realities of everyday functioning in the healthcare set-up. Emphasis was on ensuring practicality of the concepts disseminated to ensure successful on-ground implementation, in a post-training environment.

1. **Experiential Learning:** Participants were exposed to adult learning pedagogy through the use of games and activities simulating actual work environment.

2. **Case Studies:** Case studies pertaining to healthcare scenarios were used to enrich the participants on the global scenario of patient service experience. The case studies comprised of both Indian healthcare scenario as well as global healthcare practices.

3. **Role Plays:** Role plays were used to ensure that participants have an immersive experience about diverse concepts related to patient service delivery.

**Tools and Techniques for Training Transfer**

1. **Audio Clips:** Audio clips were distributed to the trainees, post the training program on areas of communication, empathy and service excellence. The objective was to encourage the participants to implement the program learnings back at the workplace.

2. **Whatsapp Chat Groups:** Whatsapp chat groups served as a platform to facilitate trainees’ query resolution and to provide necessary directions to aid on the job application of concepts delivered during the program.

**Material and Method**

A qualitative approach was adopted to assimilate data for the training intervention delivered. The information was gathered through feedback sheets and interviews with the healthcare organizations, conducted in a post-training environment, which revealed critical insights. Interviews were held with decision-makers and higher authorities working in the hospitals and medical institutions. The findings of this case study are a summary of insights gathered from training interventions conducted for healthcare organizations across India.

**Results**

Testimonials gathered from the decision-makers and authorities at various healthcare organizations where the EPR training program was conducted, revealed encouraging qualitative impact of the intervention in terms of service delivery to patients. The results generated by the training intervention include the following:

1. **Enhanced Patient Care:** The healthcare organizations that underwent the Excellence in Patient Relationship (EPR) training intervention reported favorable results amongst their workforce. Participants also reported experiencing enhanced confidence levels in dealing with patients as well as attendants, thereby excelling the service levels in the healthcare industry.

2. **Prompt Service Delivery:** Patients received prompt services from the hospital staff on several areas such as response to emergency, waiting time management, etc. which lowered the complaints against the respective healthcare organizations.

3. **Satisfied Patients and Attendants:** Increased levels of service delivery had a positive influence on the service experience of patients as well as attendants. This further had a favorable impact on the service satisfaction levels amongst patients.
Discussion

The findings of the study revealed that when employees working in healthcare organizations are exposed to training on behavioral areas alongside technical areas, they deliver superior levels of service to the patients as well as the attendants. This proves that healthcare organizations need to invest regularly in training their workforce on attributes concerning service levels such as patient communication, crisis management, ownership and accountability and other related areas. An innovative example of successful training intervention is discussed by (Batalden, Batalden, Margolis, Seid, Armstrong, Opipari-Arrigan & Hartung, 2016) (35) where more than 600 patients and 900 healthcare professionals participated in workshops that focused on essential skills for healthcare service providers including communication skills and collaborative problem solving.

Research by (Musson & Helmreich, 2004) (36) advocates that hospitals, medical institutions as well as teaching centres in healthcare must take initiative in conducting training programs on areas of Crew Resource Management (CRM) and team training. They further emphasize that training programs need to be customized to suit the culture of the healthcare organization and the employees involved. A consistent approach to training the employees would ensure patient satisfaction and enhanced reputation for the healthcare organizations. However, the investigation and feedback gathered from the hospital authorities also revealed that results of the training intervention are sustainable only when training is conducted at regular intervals and is actively supported by the top-management. Service delivery is everyone’s responsibility in the organization and hence every employee must be inducted in the service culture and sensitized to patient requirements through the Excellence in Patient Relationship (EPR) programs.

Conclusion

This case study presents key insights on the service delivery to patients in the healthcare sector and how training the hospital staff on behavioral dimensions of service delivery can enable institutions and organizations to enhance the service experience for the patients and attendants. The study had its limitations where healthcare organizations were reluctant to release their staff members to attend the program, on account of heavy workload. It was also observed that the training attendance was impacted by the fact that the programs were conducted in the hospital premises, due to which there were constant distractions for the learners. Also, the geographical coverage of the study was restricted to tier 1 and tier 2 cities in India. The researcher believes that there is a need to deliver these training programs in regions where the access and reach for quality training programs is minimal.

This study is pivotal as it contributes to the existing repository of knowledge in the healthcare sector and provides a plethora of opportunity for future research in this direction. It would be recommended that further research needs to be encouraged in understanding how training interventions such as Excellence in Patient Relationship (EPR) can positively influence the service delivery standards in healthcare organizations and ensure greater patient satisfaction levels. It is expected that this study will stimulate further investigation in future research on the domain of service in healthcare.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: The content of this case study is fully proprietary and developed by the author. No clinical trials have been conducted for the study.

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IOT Based Halitosis Detection

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ABSTRACT

Halitosis is also termed as chronic bad breath. The major cause is diabetes mellitus. The doctor often must take two tests to differentiate between ketoacidosis and halitosis. The difference between these two are ketoacidosis has acetone and ketone bodies has biomarker whereas halitosis has volatile Sulphur compounds. Designing a breath analyser with raspberry pi which as inbuilt IoT to transfer the measured readings to open source cloud and in mobile app. Through this simple device the physicians is always connected to the patient and able to monitor the subject.

Keywords: halitosis, VSC (volatile sulphur compound), breath analyser

Introduction

Diabetes Mellites which is a great threat to the healthcare and its detection in noninvasive is rare methodology. the diabetes is one of the major causes of halitosis which results exhalation of volatile compounds[¹]. Often two or many tests must be taken to differentiate between ketoacidosis and halitosis. it has acetone as biomarker which is used to detect ketoacidosis and halitosis has hydrogen Sulphide as biomarker to detect halitosis. In this project the conditions called Halitosis (Bad breath) and Ketoacidosis is detected using the Gas sensor (MQ8 & MQ138) and raspberry pi3B+ (Minicomputer). The Halitosis is detected using the Hydrogen Sulphide Gas sensor (MQ8)[²] The data from the sensors are transmitted to online cloud storage using IoT of Raspberry. The data sent to the cloud are plotted and accessed anytime using android app.

A system for detecting halitosis that comprises a gas sensor for generating a sensor signal signalling the detection of compounds indicative of halitosis exhaled through an oral cavity, an image sensor for capturing an image of a dental condition and/or tongue condition in said oral cavity and a processor communicatively coupled to the gas sensor and the image sensor and adapted to process the sensor signal and the image in order to determine if in case of the sensor signal signalling the presence of a compound indicative of halitosis, said halitosis originates from said oral cavity by determining the dental condition and tongue condition in said image. Thus, the result states it 85% accurate to the gas chromatography.

A non-invasive breath test to monitor the condition of diabetic patients where it is identified as an easier technique and quick diagnoses of diabetic ketoacidosis that prevent acute complication of type 1 diabetes mellitus. A method of monitoring ketone level by using breath measurement is done. An easy handheld health care on monitoring diabetic level with breath is presented. Method presented a development of hardware connection with Internet of Things (IoT) system to facilitate the process of patients’ diagnosis and personal monitoring. An Arduino board is used to read the sensor with sense the breath. Breath value level is log to system using wireless communication. Data collection is interfaced to web page. Ketone level is measured as the amount of breath acetone is collected when patients exhale into a mouthpiece that consists of gas sensor. This research is identified as a significant research where patients can independently monitor their diabetic health and the IoT system can be alerted directly to medial officers in the hospitals[³]. The analysis of ketone level from the breath

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is based from the resistance of the gas sensor. FIGARO TGS 822 gas sensor is used to detect the amount of gas acetone in a person’s breath. When the concentration of the acetone gas increases, the resistance of the sensor is decreased. The decrease of resistance is depending on the three factors; gas concentration, humidity and temperature. To get an accurate concentration of acetone gas in a person’s breath, humidity and temperature sensor (DHT11) is added. This is due to the sensitivity of the electrochemical gas sensor towards other gasses other than acetone. As the reading from sensor is sent to Arduino, the data is shared to the database via Wi-Fi module ESP8266. ESP8266 gives Wi-Fi networking with TCP/IP protocol stack which can give Wi-Fi connection to Arduino board so that the data can be processed and shared to the web database. Thus, the result shows that the amount of breath acetone method to determine the ketone level of diabetic patients is applicable as there is a good correlation between breath acetone levels and blood ketone levels.[6]

Sensitive detection of acetone and hydrogen sulfide levels in exhaled human breath, serving as breath markers for some diseases such as diabetes and halitosis, may offer useful information for early diagnosis of these diseases[5]. Exhaled breath analyzers using semiconductor metal oxide (SMO) gas sensors have attracted much attention because they offer low cost fabrication, miniaturization, and integration into portable devices for noninvasive medical diagnosis. However, SMO gas sensors often display cross sensitivity to interfering species. Therefore, selective real-time detection of specific disease markers is a major challenge that must be overcome to ensure reliable breath analysis. In this work, we report on highly sensitive and selective acetone and hydrogen sulfide detection achieved by sensitizing electrospin SnO2 nanofibers with reduced graphene oxide (RGO) nanosheets. SnO2 nanofibers mixed with a small amount (0.01 wt %) of RGO nanosheets exhibited sensitive response to hydrogen sulfide (Rair/Rgas = 34 at 5 ppm) at 200 °C, whereas sensitive acetone detection (Rair/Rgas = 10 at 5 ppm) was achieved by increasing the RGO loading to 5 wt % and raising the operation temperature to 350 °C. The detection limit of these sensors is predicted to be as low as 1 ppm for hydrogen sulfide and 100 ppb for acetone, respectively. These concentrations are much lower than in the exhaled breath of healthy people. This demonstrates that optimization of the RGO loading and the operation temperature of RGO–SnO2 nanocomposite gas sensors enables highly sensitive and selective detection of breath markers for the diagnosis of diabetes and halitosis. The result was highly selective and remarkably sensitive sensors to H2S and acetone were produced by mixing SnO2 NFs with RGO NSs. The SnO2 NFs were produced by electrospinning, a simple and versatile method for the fabrication of NFs of different materials. Subsequently the SnO2 NFs were mixed with GO NSs at loading levels of 0.01 or 5 wt % GO, and eventually the GO NSs were reduced to RGO by annealing in forming gas. This resulted in porous nanocomposite layers of SnO2 NFs mixed with RGO NSs. At the small RGO loading level (0.01 wt %) the electrical transport and gas sensing properties of the nanocomposite layer were dominated by the SnO2 NFs, but at the high loading level (5 wt % RGO) the RGO NSs formed continuous percolation pathways and they became the dominant component controlling the electrical transport through the nanocomposite layer.

This enabled tuning the gas sensing characteristics of the RGO NS–SnO2 nanocomposite sensors to achieve enhanced sensitivity and selectivity to traces of H2S or acetone in humid air for sensors with low or high levels of RGO loading, respectively. Besides changing the RGO/SnO2 ratio we also found that tuning the operation temperature of the sensors enabled achieving high selectivity between H2S and acetone.

A new system for detecting blood glucose levels on non-diabetic and pre-diabetic subjects by estimating the concentration of acetone in the exhaled breath using TGS822 tin oxide (SnO2) sensor which detects the concentration of acetone in the exhaled air. Acetone in exhaled breath showed a correlation with the blood glucose levels. Effects of pressure, temperature and humidity have been considered. The features are extracted and analyzed using Artificial Neural Network (ANN). The analysis of glucose levels from the breath, a total of five parameters were considered from three different sensors: Voltage and resistance from acetone sensor (Figaro TGS822), pressure from Digital barometric pressure sensor (BMP180) and temperature & humidity from DHT11 sensor. Thus, the breath acetone sensor was used for monitoring acetone levels in the exhaled breath and compared with actual blood glucose levels[6]. Thus, test results show that, it is possible to measure the blood glucose levels via breath acetone sensing.
Methodology

The gas chamber consists of three sensors such as acetone sensor (MQ138), hydrogen Sulphide sensor (MQ8) and digital humidity and temperature sensor (DHT11). The gas chamber is closed and evacuated, and values are obtained based on ppm (parts per molecule). The patient must blow inside the chamber and sensor detects the gas inside and transmit the data with help of inbuilt IoT of raspberry Pi 3B+ [7]. Digital humidity and temperature sensor are used to measure the humidity and temperature inside the chamber. The transmitted data is plotted real time in open source cloud with help API keys generated and retrieve it in need of time[8].

![Figure 1: Block diagram](image)

Gas Chamber: The gas chamber contains three sensors. Two is gas sensor and another one is temperature sensor. The gas sensor is designed like gas chamber. The dimension of the gas chamber is 255cm³. The gas chamber in this project can hold up to ppm of acetone gas[9].

MQ-138 Formaldehyde Sensor: The MQ-138 sensor is used to detect the acetone from the forceful blow of patient breath. The sensor is placed in a gas chamber where based on the gas concentration the acetone range is detected and displayed in monitor. This sensor can also detect Aldehydes, alcohols, ketones, aromatic compounds which are volatile compounds[10].

Specified Concentration range:
- 1 to 100ppm benzene
- Toluene 10 to 100ppm
- Methanol 5 to 100ppm
- Alcohol 30 to 300ppm
- Acetone 10 to 300ppm
- Formaldehyde 1 to 10ppm

MQ 8 Hydrogen Sensor: The MQ8 sensor is used to detect the hydrogen and hydrogen derivatives from the forceful blow of patient breath[11]. The sensor is placed in a gas chamber where based on the gas concentration the hydrogen and hydrogen derivatives range from 100-10000ppm can be detected and displayed in monitor.

DHT-11 Temperature and Humidity Sensor: The DHT-11 is a digital temperature and humidity sensor from micropik. A capacitive humidity sensor and a thermistor to measure the surrounding air is used which ranges from 20-90% with a resolution of 1temperature from 0-50°C with a resolution of 1 at accuracy of 2C

Raspberry PI 3B+: Raspberry pi is tiny single board computer developed by raspberry pi foundation in UK. It has Broadcom BCM2837B0 SoC with a 1.4 GHz 64-bit quad-core ARM Cortex-A53 processor with inbuilt WIFI and Bluetooth which is dual-band wireless LAN, Bluetooth 4.2/LE, faster Ethernet, and Power-over-Ethernet support.

Thing Speak: Thing speak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thing Speak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates[12].

Results and Discussion

Metal oxide semiconductors have been intensively used as solid-state sensor materials for detecting various hazardous, flammable, and pollutant gases. The gas chamber is designed in such a way to measure the values based on ppm and programming in Raspberrypi is done to sense the particular type of gas as the sensor can detect various gases[13] fig10. Shows the graph of the temperature and humidity inside the chamber as the patient may spit or blow hard inside the chamber and from fig11. We can observe the acetone and hydrogen sulphide present in the chamber. As per the ppm of the chamber and normal range is calculated for ketoacidosis is ≤30ppm and for halitosis is <20 ppm. Considering 20 subjects out of which 2 are normal and 18 are diabetic patients. The test used to compare for ketoacidosis is blood sugar test and for halitosis is strip test. The strip test involves small strips which is similar to the litmus paper by applying it to your tongue, it identifies the bacteria that causes halitosis. The obtain values is compared with other tests, from table4, we can understand that the ketoacidosis values matches the value of blood glucose level and halitosis is compared with strip test. From the results we conclude Ketoacidosis values is 95% accurate and halitosis is 90% accurate[14]. The accuracy is affected due to the food consumed recently by the subject as the
samples were taken after meals. The gas chromatography is a time-consuming process and expensive. Other tests are invasive methods and to find the cause of halitosis is difficult[15].

![Breathe Analyser Prototype](image1)

Fig. 2: Breathe Analyser Prototype

![Overall Plotted Graph for Temperature and Humidity](image2)

Fig. 3: Overall Plotted Graph for Temperature and Humidity

![Overall Plotted Graph for Ketoacidosis and Halitosis](image3)

Fig. 4: Overall Plotted Graph for Ketoacidosis and Halitosis

Table 1: Obtained Results of 20 Subjects with Compared Test

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Age</th>
<th>Temp. Inside Chamber</th>
<th>Humidity Inside Chamber</th>
<th>Acetone Level Inside Chamber (In Ppm)</th>
<th>Hydrogen Sulphide Inside Chamber (In Ppm)</th>
<th>Blood Level Glucose (Mg/Dl)</th>
<th>Strip Test For Halitosis (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>&gt;50</td>
<td>37</td>
<td>98</td>
<td>52</td>
<td>35</td>
<td>&gt;420</td>
<td>YES</td>
</tr>
<tr>
<td>2.</td>
<td>&gt;45</td>
<td>35</td>
<td>97</td>
<td>46</td>
<td>29</td>
<td>&gt;350</td>
<td>YES</td>
</tr>
<tr>
<td>3.</td>
<td>&gt;40</td>
<td>35</td>
<td>97</td>
<td>48</td>
<td>29</td>
<td>&gt;350</td>
<td>YES</td>
</tr>
<tr>
<td>4.</td>
<td>&gt;40</td>
<td>36</td>
<td>96</td>
<td>45</td>
<td>20</td>
<td>&gt;370</td>
<td>YES</td>
</tr>
<tr>
<td>5.</td>
<td>&gt;40</td>
<td>37</td>
<td>97</td>
<td>50</td>
<td>30</td>
<td>&gt;450</td>
<td>YES</td>
</tr>
<tr>
<td>6.</td>
<td>&gt;45</td>
<td>38</td>
<td>98</td>
<td>54</td>
<td>35</td>
<td>&gt;500</td>
<td>YES</td>
</tr>
<tr>
<td>7.</td>
<td>&gt;50</td>
<td>39</td>
<td>98</td>
<td>54</td>
<td>34</td>
<td>&gt;500</td>
<td>YES</td>
</tr>
<tr>
<td>8.</td>
<td>&gt;50</td>
<td>38</td>
<td>97</td>
<td>53</td>
<td>32</td>
<td>&gt;470</td>
<td>YES</td>
</tr>
</tbody>
</table>
Conted…

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9.</td>
<td>&gt;40</td>
<td>36</td>
<td>97</td>
<td>40</td>
<td>19</td>
<td>&gt;270</td>
</tr>
<tr>
<td>10.</td>
<td>&gt;40</td>
<td>37</td>
<td>96</td>
<td>42</td>
<td>21</td>
<td>&gt;300</td>
</tr>
<tr>
<td>11.</td>
<td>&gt;45</td>
<td>35</td>
<td>95</td>
<td>43</td>
<td>26</td>
<td>&gt;300</td>
</tr>
<tr>
<td>12.</td>
<td>&gt;45</td>
<td>36</td>
<td>95</td>
<td>45</td>
<td>22</td>
<td>&gt;350</td>
</tr>
<tr>
<td>13.</td>
<td>&gt;40</td>
<td>35</td>
<td>96</td>
<td>47</td>
<td>24</td>
<td>&gt;350</td>
</tr>
<tr>
<td>14.</td>
<td>&gt;50</td>
<td>37</td>
<td>99</td>
<td>50</td>
<td>36</td>
<td>&gt;400</td>
</tr>
<tr>
<td>15.</td>
<td>&gt;40</td>
<td>37</td>
<td>98</td>
<td>42</td>
<td>28</td>
<td>&gt;350</td>
</tr>
<tr>
<td>16.</td>
<td>&gt;40</td>
<td>36</td>
<td>97</td>
<td>54</td>
<td>35</td>
<td>&gt;450</td>
</tr>
<tr>
<td>17.</td>
<td>&gt;40</td>
<td>35</td>
<td>97</td>
<td>48</td>
<td>25</td>
<td>&gt;400</td>
</tr>
<tr>
<td>18.</td>
<td>&gt;45</td>
<td>36</td>
<td>96</td>
<td>49</td>
<td>25</td>
<td>&gt;400</td>
</tr>
<tr>
<td>19.</td>
<td>&gt;40</td>
<td>34</td>
<td>95</td>
<td>25</td>
<td>20</td>
<td>&lt;180</td>
</tr>
<tr>
<td>20.</td>
<td>&gt;40</td>
<td>36</td>
<td>98</td>
<td>35</td>
<td>15</td>
<td>&lt;180</td>
</tr>
</tbody>
</table>

**Ethical Clearance:** The Study is based on the Digital Processing of the sensor and its connectivity via IoT (Internet of Things). The Study is been conducted by the guidance of Head of the Department, Ms.R.J.Hemalatha. This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

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**REFERENCES**


Analysis of Polysomnography for Sleep Abnormalities

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ABSTRACT

Polysomnography test is the most commonly used test in the diagnosis of OSAS – Obstructive Sleep Apnea Syndrome and other sleep abnormalities like insomnia. PSG (polysomnography) signals consist of multiple physiological signals related to sleep and wakefulness such as subject’s EEG taken from FPZ-CZ and PZ-OZ, EMG of chin, respiratory signal, EOG signal, and Temp rectal signal. Insomnia is a sleep disorder in which the affected person suffers from the problems of lack of sleep, falling asleep or staying asleep for a long time. The main reasons for the insomnia in the individuals are mainly due to stress, anxiety, depression, pain or discomfort. In this project the classification of healthy and normal insomnia subjects taken from the online database (physionet) done based on spectral analysis of PSG (polysomnography) signals of subjects by applying FFT. The frequency domain features are obtained for the subjects and the obtained features are classified with the help of linear SVM and ANN classifiers.

Keywords: PSG (Polysomnography), FFT (Fast Fourier Transform), SVM (Support Vector Machine), ANN (Artificial Neural Network).

Introduction

Polysomnography is the diagnostic procedure that is useful in diagnosing the sleep disorders. Sleep consists of two alternating physiological states: (NREM) Non Rapid Eye Movement and (REM) Rapid Eye Movement. These states exhibit different measures in physiological signals: EEG, EOG, ECG, etc[1] The parameters that are monitored in Polysomnography are EEG, EOG, EMG of chin, respiration oro nasal and temperature of rectal. Polysomnography is used in diagnosis of sleep apnea, narcolepsy, idiopathic hypersomnia, sleep paralysis. Insomnia is a disorder of sleep, the major causes for insomnia are cardiac rhythm disruption, arthritis, bipolar disorders, and also due to hormonal problems, physical, psychological factors such as stress, anxiety, depression. Chronic insomnia, transient insomnia, and acute insomnia are the types of insomnia[2] The adequate examination of persistent insomnia requires detailed sleep historical information as well as medical, psychological and psychiatry assessment[3] The female excess in the risk of insomnia in large and quality studies was much higher than that of small non quality studies[4]. The classification of the healthy and insomnia subjects asleep abnormalities are done using PSG by analyzing the parameters of the signals taken from the EEG[FPZ-OZ-CZ], EOG[Horizontal], EMG [Surface chin], Temp rectal, Respiratory Oro Nasal. The polysomnography signals of the male and female subjects taken from the online database (physionet) are spectrally analyzed by applying FFT to the signal and the abnormalities are detected by analyzing the features extracted from the polysomnography signals

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and offline based feature extraction and classification methods are explored. The proper extraction of suitable features from the signal was done by applying variational mode decomposition. Two features are extracted from the variational mode functions (VMFs) namely energy and RR interval of ECG signal. These features are fed in to a support vector machine classifier where they are classified as healthy and apnea. The accuracy obtained for both online and offline processes are 97.5% and 95% respectively.

Classification on the healthy and insomniac subjects based on the wake to sleep transitions features. Extracted the feature from the signals using non-parametric methods in frequency domain \( [5] \). Wavelet transforms are used to calculate the non-parametric features; relative power of EEG sub bands. The statistical analysis was applied on the features obtained. The data was divided into two groups training data and testing data. Classification tree model was executed on training data to predict the healthy and insomniac groups in test data. for estimation the k-fold cross validation method was used \( [6] \).

A simplified efficient insomnia detection algorithm of polysomnography based on central single electroencephalographic (EEG) channel (C3) using only deep sleep. Also analyzed several spectral and statistical EEG features of good sleeper controls and subjects suffering from insomnia in different sleep stages to identify the features that offered the best discrimination between the two groups. The proposed algorithm was evaluated using EEG recordings from 19 patients diagnosed with primary insomnia (11 females, 8 males) and 16 matched control subjects (11 females, 5 males). The sensitivity of the algorithm is 92%, the specificity is 89.9%, the Cohen’s kappa is 0.81 and the agreement is 91%, indicating the effectiveness of the proposed method.

Classification of the brain waves alpha, beta theta and delta by extracting the features. EEG signal filtered by using different types of filters to remove the unwanted frequency components from the original signal and to extract the features or information about the signal with the help of different efficient DSP tools like DFT, FFT, STFT and wavelet transform. FIR band pass Butterworth filter are used to filter the EEG signal and analyzed the filtered signal with the help of FFT. The lab view software tool is used to this work as it is easier to MATLAB software because there is programming is not used in lab view.

The emotions on brain activity due to the effects of two different types of Hindustani music using Electroencephalography (EEG) data. Two different sets of Hindustani music raga clips of contrasting emotion (romantic/sorrow) were used in the study. EEG was performed on five male subjects while they listened to the clips. The linear analysis of their alpha and delta spectral power showed that in most cases arousal-based activities were enhanced in both the subjects while they listened to the two music clips. A robust nonlinear method called Detrended Fluctuation Analysis (DFA) is used to analyze the scaling behavior of the observed fluctuations in EEG. The scaling exponent \( (\alpha) \) values determined for the different experimental conditions show different levels of neural activity when the two different types of music are played.

Methodology

The polysomnography signals are used to examine the sleep and can be used to determine all the sleep related abnormalities like insomnia, hypersomnia, sleep apnea, sleep paralysis \( [7] \). The polysomnography signals have been filtered and smoothened for enhancement and then the signals are allowed for spectral analysis by applying FFT to the signal and then the feature values are extracted from the subjects the extracted statistical values are classified using linear SVM classifiers and Artificial neural network.

Data Acquisition: In this study, the polysomnographic signals of a 3 female and 3 male (volunteered subject) are acquired from the physionet(online) database that contains 61 PSG signals. The PSG signal consists of EEG (taken from FPZ-CZ and PZ-OZ electrode location), EOG (horizontal), EMG (sub mental chin), ORO nasal respiration and rectal body temperature signals. The PSG (polysomnography) signals are taken for 20 hrs. of time period during 2 subsequent period at the subject’s home.

EEG Signals: EEG FPZ-CZ and PZ-OZ signals that are acquired from the various regions exhibits different sleeping pattern waves with different frequencies. The EEG signals are filtered with band pass filters at the cut off frequency range of 0.5 -4.0 Hz \( [9] \) and then the signals are smoothened at a sampling rate of 100. The filtering and smoothening of the signals are done for the enhancement for the further processing.
**EOG Horizontal:** EOG horizontal signals are filtered with low pass filter with the frequency range of 5Hz are passed and other signal are attenuated and then the signal is smoothened for enhancement of the signal [10].

**EMG Submental Chin:** EMG submental chin signals are filtered with high pass filter with the frequency range of 100 and the other signals are attenuated and then the signal is smoothened for the enhancement of the signal [11].

**Resp Oro Nasal and Temp Rectal:** Respiration oro nasal signals and temp rectal signals are smoothened at 100 samples rate as the respiration signals are already filtered in the database itself and temperature signals doesn’t require filtering [12]. Smoothening of signals are done to enhance the signals.

### Spectral Analysis

FFT (Fast Fourier Transform) is the algorithm that samples the signal over period of time and divides into components. Fourier analysis converts a signal from its original domain to representation in frequency domain [13]. The mathematical representation of fast Fourier transform is given as, $x[K]=\sum_{n=0}^{N-1}[x[n]W_n^nk]$.

FFT is an important and efficient tool for the feature extraction. FFT algorithm is involved a wide range of mathematical operation from simple real and complex numbers. Fourier analysis converts a signal from its original domain to a representation in the frequency domain and vice versa. An FFT rapidly computes such transformations by factorizing the DFT matrix into a product of sparse (mostly zero) factors. Fast Fourier transforms are widely used for many applications in engineering, science, and mathematics. The preprocessed signals have been applied with the FFT to analyze the signal by converting from its original time domain to the frequency domain for obtaining the frequency domain features of the signal [14].

### Feature Extraction

The features that are extracted from the signals are mean, median, min, max, skewness and kurtosis.

### Classification

The extracted features are then averaged and then these statistical features are classified with two different classifiers, they are linear SVM classifier and Artificial Neural Network. Support Vector Machines are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. A support vector machine constructs a hyperplane or set of hyperplanes in a high or infinite – dimensional space, which can be used for classification, regression or other tasks like outlier’s detection. Artificial neural networks (ANN) are computing systems that are inspired by the biological neural networks that constitutes animal brain. The neural network itself isn’t an algorithm, but rather a framework for many different machine learning algorithms to work together and process complex data inputs. Artificial Neural Network is based on collection of connected nodes or units called artificial neurons. The application areas of ANN include signal classification, pattern recognition and sequence recognition.

### Results and Discussion

The polysomnography signals obtained from the online database (physionet) of 6 subjects have been preprocessed and are spectrally analyzed by applying FFT to the signal and then the statistical features for 6 subject’s EEG FPZ-CZ, EEG PZ-OZ, EOG HOR, EMG submental, RESP ORO and TEMP RECTAL have been obtained. The obtained features are min, max, median, mean, skew, and kurtosis. The feature values of each subject have been averaged [15]. The classification have been done for the averaged feature values by using linear SVM classifier and ANN classifier. The averaged feature values subjects1, 3, 5 from the table 1 found to be higher than the remaining 3 subjects. The classification of the averaged feature values is done using SVM classifier and ANN classifier, The classifier outputs are shown in figure3 and figure4 and the averaged statistical values comparison graph was shown in figure 2.

### Summary and Conclusion

The polysomnography signals obtained from the physionet database that consists total 62 subjects. In this project we have analyzed 6 polysomnography signals that contains EEG PZ-OZ, EEG FPZ-CZ, EOG HORIZONTAL, EMG submental chin, TEMP RECTAL and RESPORO NASAL signals. In that polysomnography signals we have taken 6 subjects (normal and abnormal) at the age group 26-35. All the polysomnography signals are analyzed in this project. The raw EEG signals are band pass filtered within the range of 0.5-4 Hz and then the signal is smoothened for enhancement and then the FFT is applied to the signal and the various features like min, max, mean, median, skew and kurtosis are extracted. The averaging of the extracted features is done and then the classification is done by applying the SVM and ANN classifiers. The same methodology is applied for all other polysomnography signals except that the filtering characteristics are changed to low pass filter for EOG signals within range of 5Hz, high pass filter for EMG signals.
submental chin with range above 100Hz, the respiration and temperature signals are only smoothened.

The normal and abnormal subjects have classified using the classifiers SVM and ANN. On analyzing the results of classifier the subject 1, 3, 5 are grouped separately and the subjects 2, 4, 6 are grouped separately, the feature values of subject 1, 3, 5 found to be higher than the subjects 2, 4, 6. On analyzing the dataset taken from the physionet the subjects 1, 3, 5 found to be insomnia subjects and the subject 2, 4, 6 are normal subjects. The classifier results found to be 83.3% accuracy in Linear SVM classifier, and 100% accuracy in ANN classifier.

**Ethical Clearance:** The Study is based on the Digital Processing of the sensor and its connectivity via IoT (Internet of Things). The Study is been conducted by the guidance of Head of the Department, Ms. R.J. Hemalatha. This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

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**Conflict of Interest:** Nil

**REFERENCES**


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Computer Aided Classification of Breast Lesions in Digital Mammograms

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¹Department of Biomedical Engineering, Vels Institute of Science Technology and Advanced Studies, Chennai, India

ABSTRACT

Objective: Mammography technique is mostly used for detecting the presence of abnormal breast lesions among women. Differentiating these abnormalities is a most difficult task faced by the radiologists. By using this proposed technique the rate of unnecessary biopsies can be limited. This paper deals with an effective way of detecting the breast lesions using curvelet transform. This proposed paper follows a stepwise procedure such as (a) Preprocessing(b) Region of Interest Segmentation. (c) Applying Curvelet Transform (d) Feature Extraction & finally (e) Classification of features using different kernels of SVM. It is inferred from the observed results that the SVM(Linear) classifier showed a good accuracy rate of 80%.

Keywords: Mammogram, MIAS Database, Cancer Detection, Benign, Malignant, Curvelet transform

Introduction

Breast Cancer is considered as a most common type of lesion that has got great attention in the last few decades. This is because of the high death rates found among young women in the whole world. A Statistical report taken by Harvard School of Public Health⁴ reveals that breast cancer cases will increase to 26% from now on till 2020 in the developing countries. With respect to this context, the diagnosis of breast lesions is totally dependent on radiologist’s ability to read and check the quality of the images. Computer aided designs helps radiologists to sort out abnormalities in the breast lesions. Medical Image processing⁵ plays an vital role in this aspect. Candes etal⁶ suggested a better approach namely Curvelet to explicitly track the shape of the discontinuity in mammograms and how this method differs from wavelet. In this approach only the discontinuities were only tracked.

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Database for this work is taken from mini-MIAS. Each mammogram from the database has 1024 X 1024 pixels with a spatial resolution of 200 m/pixel. Detecting abnormalities from Mammogram images in this proposed methodology is divided into five stages. The first stage includes preprocessing of the image, the second stage includes the segmentation of Region...
Of Interest (ROI), the third stage is the extraction of curvelet coefficients using curvelet transform. The fourth stage involves extracting features from ROI and finally the fifth stage is the image classification process. The suggested system is worked out using MATLAB 2015a.

The preprocessing step is performed in order to reduce the noise, enhance the image and remove the background area. It is difficult to differentiate between abnormal and normal lesions due to low contrast of mammogram images. The mammogram images were changed to gray scale. Its contrast was enhanced such that the output image’s histogram approximately matches a specified histogram and noise was removed from it using median filter.

**Segmentation:** Segmentatio[6] is an effective way for detecting the breast lesions in mammograms. The watershed method is used in this proposed paper. Segmentation using the watershed method includes identifying a mark on the foreground object and background locations. Watershed segmentation follows this basic procedure explained as follows: The first step is to convert the rgb images to gray-scale. Then an edge detection function is used to develop a gradient image. Morphological reconstruction is used for marking the foreground image. In order to obtain a good forward marker the regional maxima and minima are calculated. Finally the foreground marked image is superimposed on the original image.

**Curvelet Transform:** Curvelet transform[2] is a new multi-scale transform based upon wavelet transform. Its factors include directions besides scale and position which makes it to have a better directional characteristics. In most of these images there are many curves. So here we must divide image into pieces, the curve is close to a single line in each piece. Then the image is decomposed into sub-band, and further it is divided into images with different scales into pieces. A better result will be achieved by all these process which includes subband decomposition, smooth partitioning and ridgelet analysis. Ridgelet analysis is the main algorithm which includes 2D FFT, interpolation, 1D IFFT in polar coordinate system, and 1D wavelet transform in Radon domain.

**Feature Extraction:** Feature extraction plays an important role in classifying mammograms. Statistical features are used here to determine the texture of mammograms.

Some main features that could be defined and calculated are mentioned below:

1. **Contrast:** It is a measure of the intensity contrast between a curvelet coefficient and its neighbour of the entire image. It is given by the equation (2.1) as follows.
\[
\sum_{i,j} |i-j| p(i, j)
\] 
\[\text{(2.1)}\]

2. **Correlation:** It is a measure of how correlated a coefficient is to its neighbour over the whole image. It denoted by the equation (2.2) as follows.
\[
\sum_{i,j} \frac{(i-\mu_i)(j-\mu_j)p(i,j)}{\sigma_i}
\] 
\[\text{(2.2)}\]

3. **Energy:** It is given by the sum of the square of the elements in the GLCM. Energy measures the textural uniformity which means the pixel pairs repetitions. It also measures the smoothness of the image. It is given by the equation (2.3) as follows.
\[
\sum_{i,j} (P_{i,j})^2
\] 
\[\text{(2.3)}\]

4. **Homogeneity:** It measures the closeness among the curvelet coefficients in the Gray Level Co-occurrence Matrix (GLCM) and GLCM diagonal. It is given by the equation (2.4) given below.
\[
\sum_{i,j} \frac{p(i,j)}{1+|i-j|}
\] 
\[\text{(2.4)}\]

5. **Autocorrelation:** It describes how well an image correlates within itself. It can be observed under conditions where it is displaced with respect to itself in all possible directions.

6. **Entropy:** Entropy is the measure of an image’s randomness that can be used to characterize the texture of an image. It is a quantitative measure of image information. It is denoted by the equation (2.5) below.
\[
\sum_{i,j} \sum_{P(i,j)} P(i,j) \log(P(i,j))
\] 
\[\text{(2.5)}\]

**Classification**

**Support Vector Machine:** SVM is one of the supervised learning methods for classification and regression. They belong to the linear classifier family, generalized in nature. They can minimize and maximize the empirical classification error and geometric margin respectively. Therefore SVM is also known as Maximum Margin
Classifiers. The input vector can be mapped to a high dimensional space where a hyperplane is constructed with maximal separation. At the each side of the data, two parallel hyperplanes are constructed such that it separates the data. This separating hyperplane maximizes the distance between the two parallel hyperplanes. In general, if the distance between the two hyperplanes is maximized by this separating hyperplane, the generalization error will be minimized.

To understand the basics of SVM, a simple example can be explained where 2 different features are taken into account, namely x and y. A classifier is needed such that the given pair of output can be grouped. The SVM at first takes these given data and separates it using a decision boundary, which into two groups. One falls on one side and the next on either side of the boundary. The distance of the hyperplane to the nearest element of each tag is the largest.

In the case of non-linear data, a new dimension named Z is calculated which is the third dimension in addition to x and y. It is given by \( z = x^2 + y^2 \) which will denote a three-dimensional plane. Here the hyperplane should be parallel to x axis at certain Z. This is how a SVM classifies the input data. The algorithm of SVM is given below as follows.

Algorithm 1: SVM:

1. Load the Dataset.
2. Classify the given features, based on the class.
3. Find the estimation of support value.
While (instances! = null)
  Do
    4. Find the similarity between each instances in the attribute.
  5. Estimate the error value totally.
  6. If the instance < 0
    7. Support value/Total Error = Estimated Decision Value
    8. Until Empty Repeat again
EndIf

Results and Discussion

In this paper, totally 20 mammogram images are used as inputs, out of which 10 are benign and 10 are malignant. Out of these 20 images, depending upon the abnormality classes, 7 images are circumscribed masses, 6 images are ill-defined masses and remaining 7 images are with calcifications. Here 12 images are used for training and remaining 8 images are used for testing.

A Sample of normal and abnormal mammograms from MIAS database with 1024*1024

The abnormal mammogram is preprocessed using contrast enhancement and noise is removed using median filter.

Then the ROI from the preprocessed image is segmented using watershed method.

Curvelet transform is applied for the segmented lesion and thereby the feature values are extracted from the obtained curvelet coefficients. They are shown in the Table 1 & Table 2 below.

Table 1: Features of Benign Mammograms

<table>
<thead>
<tr>
<th>Features Image No</th>
<th>Contrast</th>
<th>Correlation</th>
<th>Energy</th>
<th>Homogeneity</th>
<th>Autocorrelation</th>
<th>Entropy</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>0.001880</td>
<td>0.0006870</td>
<td>0.997000</td>
<td>0.999000</td>
<td>1</td>
<td>0.003887</td>
</tr>
<tr>
<td>2</td>
<td>0.02400</td>
<td>0.01490</td>
<td>0.97300</td>
<td>0.993000</td>
<td>1.020000</td>
<td>0.05405</td>
</tr>
<tr>
<td>3</td>
<td>0.006340</td>
<td>0.033000</td>
<td>0.9910000</td>
<td>0.998000</td>
<td>1.010000</td>
<td>0.007346</td>
</tr>
<tr>
<td>4</td>
<td>0.02410</td>
<td>0.01490</td>
<td>0.967000</td>
<td>0.991000</td>
<td>1.0210000</td>
<td>0.04417</td>
</tr>
<tr>
<td>5</td>
<td>0.009280</td>
<td>0.012000</td>
<td>0.9880000</td>
<td>0.99700000</td>
<td>1.0100000</td>
<td>0.008580</td>
</tr>
<tr>
<td>6</td>
<td>0.051600</td>
<td>0.052500</td>
<td>0.9320000</td>
<td>0.98200000</td>
<td>1.0400000</td>
<td>0.061630</td>
</tr>
<tr>
<td>7</td>
<td>0.020800</td>
<td>0.018900</td>
<td>0.9780000</td>
<td>0.99400000</td>
<td>1.0100000</td>
<td>0.020800</td>
</tr>
</tbody>
</table>
Table 2: Features of Malignant mammograms

<table>
<thead>
<tr>
<th>Features Image No</th>
<th>Contrast</th>
<th>Correlation</th>
<th>Energy</th>
<th>Homogeneity</th>
<th>Autocorrelation</th>
<th>Entropy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.03740</td>
<td>0.02580</td>
<td>0.95956</td>
<td>0.9891</td>
<td>1.0268</td>
<td>0.027408</td>
</tr>
<tr>
<td>2</td>
<td>0.03322</td>
<td>0.01830</td>
<td>0.95587</td>
<td>0.988466</td>
<td>1.026769</td>
<td>0.013225</td>
</tr>
<tr>
<td>3</td>
<td>0.06677</td>
<td>0.027307</td>
<td>0.93085</td>
<td>0.981414</td>
<td>1.04765</td>
<td>0.05678</td>
</tr>
<tr>
<td>4</td>
<td>0.03582</td>
<td>0.03601</td>
<td>0.95284</td>
<td>0.98777</td>
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<td>0.02852</td>
</tr>
<tr>
<td>5</td>
<td>0.04903</td>
<td>0.05479</td>
<td>0.95049</td>
<td>0.986853</td>
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<td>0.03902</td>
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<tr>
<td>6</td>
<td>0.02394</td>
<td>0.03615</td>
<td>0.97146</td>
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<td>1.01835</td>
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<tr>
<td>7</td>
<td>0.03740</td>
<td>0.04870</td>
<td>0.95674</td>
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<tr>
<td>8</td>
<td>0.03170</td>
<td>0.00908</td>
<td>0.95811</td>
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</tr>
<tr>
<td>9</td>
<td>0.06860</td>
<td>0.01593</td>
<td>0.92093</td>
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<td>1.05174</td>
<td>0.0386</td>
</tr>
<tr>
<td>10</td>
<td>0.0352</td>
<td>0.03222</td>
<td>0.96699</td>
<td>0.99118</td>
<td>1.023185</td>
<td>0.02522</td>
</tr>
</tbody>
</table>

To validate the performance of classifier three different metrics have been selected, the measures are like accuracy, specificity and sensitivity are calculated based on the Actual and predicted values from confusion matrix, which consists of parameters such as True Positive, False Positive, True Negative and False Negative. Their formulas are given below as follows.

Accuracy = (TP + TN)/(TP + TN + FP + FN)

Sensitivity = (TP)/(TP + FN)

Specificity = (TN)/(TN + FP)

Where TP = True positive: Abnormality correctly classified as Abnormal. FP = false positive : Normal incorrectly classified as Abnormal

FN = false negative: Abnormality incorrectly classified as normal, and TN = True negative: Normal correctly classifies as normal.

The execution of a classifier could be assessed as far as the quantity of TP and FP. The actual and predicted values are found for different kernels of SVM from the confusion matrix and are shown below in the figures 1,2,3 respectively.
The performance analysis of these classifiers are found and are shown in table 3 below as follows.

**Table 3: Performance Analysis of classifiers**

<table>
<thead>
<tr>
<th>Classifier (kernel)</th>
<th>Accuracy</th>
<th>Specificity</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVM (Linear)</td>
<td>80%</td>
<td>75%</td>
<td>87.5%</td>
</tr>
<tr>
<td>SVM (Cubic)</td>
<td>75%</td>
<td>77%</td>
<td>72%</td>
</tr>
<tr>
<td>SVM (Quadratic)</td>
<td>75%</td>
<td>88%</td>
<td>77%</td>
</tr>
</tbody>
</table>

From the above analysis, it can be concluded that SVM classifier with linear kernel gives a better performance for classification when compared to other kernels.

**Conclusion**

In this paper, various steps were implemented for the breast lesions classification. The proposed approach consists of Image Preprocessing, Watershed Segmentation, applying Curvelet Transform, Feature Extraction [GLCM] and comparison of classification using different kernels of SVM. SVM(linear) proved its performance via performance metrics such as Sensitivity is 87.5%, Specificity is 75% and its Accuracy in classification is 80%. This system of classification shows better performance when compared with existing methods, so it is very helpful to the medical people in detecting tumor.

**Future Scope:** In future, different classification techniques such as Bayesian, Gauda-Krishna Nearest Neighbor Algorithm etc can be done. Apart from this, the sub classification of breast lesions can also be found.

**Ethical Clearance:** This Study does not require Ethical Clearance.

**Source of Funding:** It is one of the Self-funding work of Students of Department of Biomedical Engineering.

**Conflict of Interest:** Nil

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Classification of EEG Signal into Different Epileptic Stages Based on Feature Extraction

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¹Assistant Professor, ²Student, Department of Biomedical Engineering, Vels Institute of Science Technology and Advanced Studies, Chennai, India

ABSTRACT

Epilepsy affects almost 50 million populations worldwide and it is one of the most common disorders of the neurological system. Epilepsy is characterised by chronic seizures with a broad range of seizure types based on the condition that differs from one person to another. There various diagnostic modes such as EEG, Magnetic Resonance Imaging (MRI) and fMRI. In this paper, we have made an approach to classify epileptic seizures of EEG signals with ease, instead of using complex and ancient methods of decision making and to describe and find out which wave has significant disturbance in the Epileptic condition. In the work carried out, firstly, the EEG signals were split into separate frequency band wave and time-frequency features were extracted. Then, the extracted features were fed to classifier system, the Linear SVM and ANN classifier and the performances between the classifier were compared in terms of Accuracy, Sensitivity and Specificity.

Keywords: Electroencephalogram (EEG), Epilepsy Linear SVM, ANN.

Introduction

A seizure is an electrical disturbance in the brain caused by the firing of the brain cells. According to an estimation of the World Health Organization, almost 50 million of the world population is affected by epilepsy[1]. Seizures can be divided into three main categories: Focal onset, generalized onset, or Unknown onset. The onset of seizure is on both the sides of the brain at the same time. The absence seizure is one form of a generalized seizure in which larger part of the brain gets disturbed. The three absence seizures are Seizure free, pre-seizure and seizure.

EEG measures the changes resulting from ionic potential within the neurons of the brain. EEG is considered to be a valuable tool for diagnosis and research though it has limited spatial resolution. There has been works to suggest best methods for classifying seizure stages using EEG signal. Simple Random Sampling (SRS) technique combined with Sequential Feature Selection (SFS) were used to get best features for epileptic signal classification [3]. The classification was presented with 99.90%, 99.80% and 100% of accuracy, sensitivity and specificity respectively. Later, using wavelet decomposition and extracted time and frequency domain features, obtained new feature space with ANOVA, 99% classification accuracy was obtained using KNN, SVM, Naïve Baye classifiers [7].

High frequency oscillations were used to discriminate ictal and inter-ictal EEG signals of epileptic seizure patients and received satisfactory outcome on it [9]. Then, different supervised (SVM) and unsupervised (k-MC) learning algorithms were used for classifying the epileptic seizure phases [5]. Comparisons were made with two traditional methods, namely K-Nearest Neighbour (KNN) and Naïve Bayes classifier and it was evaluated that SVM outperform the traditional methods in terms of accuracy.

In this work time-frequency features are extracted and classification using Linear SVM and ANN classifier are performed to classify the three conditions viz., Normal, Inter ictal and Ictal. EEG, being a highly non-
stationary levels signal, the energy distribution at different frequency levels can be classified in a precise form using Time-frequency distributions. Efficient automated seizure detection techniques can facilitate the diagnosis of epilepsy and also enhance the management of long-term EEG recordings \(^2\).

The brain waves are generally divided into 5 frequency bands:

- **I. DELTA (0-4Hz):** Occur in the state of deep, dreamless sleep. These are the slow and deep penetrating brainwaves.
- **II. THETA (4-8Hz):** Occurs during deep sleep or meditation.
- **III. ALPHA (8-16Hz):** Occurs during calm and relaxed state, with the awareness of the presence.
- **IV. BETA (16-32Hz):** Occurs when a person is fully awake, more focused and alert.
- **V. GAMMA (32-64Hz):** Peak performance and state of perception.

**Methodology**

EEG signals are weak and have low amplitude; hence they suffer from complex low frequency noise such as system or power interference \(^0\). So, the EEG signal pre-processing with noise removal is a significant step for the epileptic seizure analysis, detection and classification. Thus, in this proposed work, a low pass butter-worth filter for noise removal and decomposition of signals is used. Nine time-frequency domain features were extracted from the decomposed band of EEG signals namely, Delta, Theta, Alpha, Beta and Gamma. Support Vector Machine (SVM) and Artificial Neural Network (ANN) classifier were applied and the performance of the classifiers was compared.

**Data Acquisition:** The EEG dataset used in this work was recorded at the University Hospital Bonn, Germany (Sets F, Z and S) taken from the publicly available online EEG time series data \(^1\). EEG, each of 23.6 seconds duration, collected at a sampling rate of 173.61 samples per second resulting in each of the subsets that includes 100 segments with a sampling frequency of 173.61 Hz and a duration of 23.6 s, i.e., 4096 sample points, the corresponding Nyquist frequency bandwidth is 86.8 Hz. Taken from five epileptic patients at times of normal, inter-ictal and ictal activity were recorded intra-cranially with the identical 128 channel amplifier system.

**Pre-Processing:** Usually, the signals acquired from any system, consists of distortions and artifacts. The major and the one of the most important steps in the Medical signal processing is to remove the noise, based on the statistical and spectral characteristics of the signal. The filtered signal will have higher spectral efficiency and stability than the normal raw signal. This improves decomposition stage of the signal to be more accurate. The butter-worth filter is used to decompose the EEG signal to five frequency bands, as the frequency response of this filter gives fewer ripples in the pass band and stop band.

**Feature Extraction:** A feature represents a measurement and distinguishing functional component obtained from a section of a signal pattern. These features can reduce the loss of key information embedded in the signal significantly. To obtain and classify the functions of brain over a period of time, the features were calculated from the EEG in Time-frequency domain. The Time-Frequency [TF] domain features which were included in the process are Mean, Median, Standard Deviation, Skewness, Kurtosis, RMS, Shannon Entropy, Power Spectral Density [PSD], band power, Peak to peak of a signal are taken. The above features were extracted for all the five bands of frequencies.

**Classification:** In machine learning algorithms, Support Vector Machines are the supervised learning models with associated learning algorithms that analyze data for classification and regression analysis. A Support Vector Machine constructs a hyper-plane in a high dimensional space, which can be used for classification, regression, etc. Artificial Neural Network (ANN) \(^5\) is an information processing algorithm that is inspired by the biological nervous systems i.e., the brain and the neurons, process information. The kernel part of this paradigm is the novel structure of the information processing system. It is comprised of a huge number of highly interconnected processing elements (neurons) working in conjunction to solve specific problems. The efficiency of the classifiers and the methods are stated in terms of Accuracy, specificity and sensitivity. The Neural Network or SVM is trained with different bands such as delta, theta, alpha, beta and gamma for three different conditions of the epileptic seizures namely Normal, Ictal, Inter-ictal. MATLAB is the software used and confusion matrix of the classification was used to evaluate the results. The true-classification and misclassification of the data was also interpreted between the classifiers.
Results

The extracted features were fed to the SVM and ANN classifier for classification of the conditions like Normal vs. Inter-ictal, Inter-ictal vs. Ictal and Normal vs. Ictal and also between the five band waves of EEG.

Figure 1 shows the accuracy comparison between each EEG band and between the stages of the seizure. Alpha band shows significantly high accuracy in all the three stages of comparison i.e., 90%, 95% and 96% accuracy while classifying between Normal vs Inter ictal, Normal vs Ictal and Ictal vs Inter ictal respectively. From the above comparison it is clear that SVM classifier shows better classification between the seizure stages especially between Inter ictal and Ictal SVM gives an accuracy of 99%. Hence, we conclude that the response of the theta wave and Linear SVM classifier may be used for the diagnosis and might give better results in pre-diagnosis of Epileptic seizures at earlier stages.

Ethical Clearance: The Study is based on the Digital Signal Processing. The Study is been conducted by the guidance of Head of the Department, Ms.R.J.Hemalatha. This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

Source of Funding: It is one of the Self-funding projects of Department of Biomedical Engineering.

Conflict of Interest: Nil
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Design and Development of Low Cost Prosthetic Hand Controlled by Myoelectric Signal

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1Assistant Professor, Department of Biomedical Engineering, Vels Institute of Science Technology and Advanced Studies, Chennai, India

ABSTRACT

Amputee are the people who lost their part of the body due to various reason like accidents, trauma or any diseases. In this project hand amputees who suffer to do their daily activities like eating, holding the objects etc have been considered. Myoelectric signal is an electrical impulse that produces contraction and relaxation of muscle fibers which controls movements of the body. EMG controlled prosthetic device has more advantage because it will be activated by bio signal which is the part of their own body. In this project we focus on development of light weighted prosthetic hand. The developed prosthetic hand will be controlled by processed EMG signal acquired by placing electrodes on specific muscle to perform hand gesture movements. The developed light weight prosthetic hand controlled by EMG signal will be very useful for hand amputee to do their chores with ease.

Keywords: Amputees, myoelectric signal, Prosthetic hand

Introduction

The people who lost their part of the body due to various reason like accidents, medical illness, trauma or other reasons are known to be amputee, who majorly suffer in doing their daily activities like eating, holding the objects, etc[1,8]. Rehabilitation may be defined as reintegration of an individual with a disability in the society. One of the major challenges for prostheses development is to produce devices to mimic their natural counterparts [4]. They are purposively designed for a specific task, showing high dexterity in task-oriented preprogrammed applications in structured scenarios, but featuring low anthropomorphism and low manipulation capability [2]. Prosthetic applications of robotic technologies impose a series of challenging requirements regarding the cosmetic appearance, the size and the weight of the hand, and its embeddable control system, which is crucial for obtaining reliable and robust hand acceptable for end users [2].

Literature Survey

3D modelling is the key technique to much research and applications including Tissue Engineering and heritage protection [3]. The majority of electrically powered prosthetic hands are based on a simple design that limits motion to a one degree of freedom. Designs of multi-articulated prosthetic hands have had limited success due to their complexity and number of mechanical components [4]. The design separates the strength space of the muscles into a lighter strength region. Two parallel actuator types and kinematic structures are designed to complement the requirements of both strength space regions [5]. Prothesis is an artificial extension that replaces a missing part [7]. The muscle in the remaining part of the amputees functions in normal way, enabling the electromyogram signals which can be used for controlling the prosthetic arm [6].

M.a.rikamanlapaz et.al have developed a low cost surface 3D printed hand gesture recognition system [9]. Gesture are used to control the movement of 3D printed arm. Ramlee et al [10] have designed the 3D printed
prosthetic hand using ABS filament and tested the power of each finger. There were more difficulty in using EPE foam for developing fingers [11].

**Methodology**

This study develops a methodology to design and develop the prosthetic hand controlled by myoelectric signal. The block diagram of the study is given in Fig.1. The prosthetic hand is designed using computerized software and it is fabricated. The Surface Electromyography is obtained using muscle sensor and the acquired signal is processed and given to the microcontroller. The actuator gets a signal from the controller and the actuation of the developed prosthetic hand is achieved.

**Fig. 1: Block Diagram**

**Design of Prosthetic Hand:** Computer-aided design (CAD) is used to design the prosthetic hand. CAD is the use of computer systems to aid in the creation, modification, analysis, or optimization of a design. CATIA is the most powerful and widely used CAD (computer aided design) software. It delivers a unique open and extensible systems integrates the cross-discipline modeling, simulation products. Finger, palm and full hand design was developed in CATIA and showed in fig.2-4.

**Fig. 2: Finger design using CATIA**

**Fig. 3: Palm designed using CATIA**

**Fig. 4: Full hand image designed using CATIA**
Muscle Selection: Surface EMG is relatively easy to use as compared to other EMG electrodes. This is the reason why it is being extensively used in the control of robotic mechanisms to achieve prosthesis. Its use in rehabilitation prosthesis is favorable as it does not cause any kind of discomfort to the subject on whom it is applied. Other kinds of EMG electrodes (needle and fine wire), when inserted into the skin of the subject, may effect a twitching sensation and cause him or her to make movements. In order to get the best results from SEMG, it is really important to have a proper understanding of the muscles from which the EMG signal is being extracted. The placement on skin also requires adequate study and requires skin preparation beforehand as well. Group of flexor muscles selected were: Flexordigitorum superficialis, Flexordigitorum profundus, Interosseous muscle, Flexorpollicislongus, Flexorpollicisbrevis.

The muscle sensor measures a muscle’s activity by monitoring the electric potential generated by muscle cells and produces an analog output signal that can be read by a microcontroller. As the target muscle group flexes, the sensor’s output voltage and the muscle activity can be fine-tuned using an on board gain potentiometer of the closing parenthesis.

Result and Discussion

Developed Prosthetic Hand: This is the total setup of the signal acquisition part. This consist of muscle sensor, stepdown transformer, bridge rectifier, arduino uno microcontroller, servo motors (2), TTL/232. The signal has been acquired using the muscle sensor by placing over the skin. The values is noted at the time of muscle contraction and relaxation. The developed prosthetic hand is shown in fig 5.

The designed hand model is efficiently used for the Amputee people who lost their hand due to various accident and injuries. This paper covers the details of the steps followed in designing prosthetic hand. The work proposed and implemented by many researchers has been discussed. The effect and role of every step in designing prosthetic hand has been explored. The advances in computation techniques have allowed discrimination of motion very precisely. Several techniques have been developed to control multifunctional prosthetic devices, and many of them showed promising result. Moreover, these techniques could be also applied in other fields, not only in the control of myoelectric prosthesis. The work can be extended to provide the feedback from the sensors to brain, which will allow the amputee to provide better natural feelings.

Future Scope

The future work is extended to develop the hand by EPE(Expanded polyethylene foam). The future work shows a new concept of prosthetic arm in which the regular solid 3D fingers are replaced with EPE foamed fingers. Some parts like hand sleeve are made of thin acrylic so as to further reduce the cost by avoiding 3D printing where ever possible. EPE, by its material characteristics provides good spring back which helped in opening the grip automatically, thus avoiding the use of extra elastic bands.

Ethical Clearance: The Study is based on the design and development of prosthetic hand. The Study is been conducted by the guidance of Head of the Department, Ms.R.J.Hemalatha.

This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

Source of Funding: It is one of the Self-funding projects of Department of Biomedical Engineering.

Conflict of Interest: Nil

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A Review on Biometric Technology in Healthcare

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ABSTRACT

Biometrics system can be defined as the body’s measurement used for identification and authentication process. Biometrics is used to detect and examine the measurable characteristics of the individuals. Biometric technology used in various applications in different fields. In emerging medical field, biometric technology like fingerprint recognition systems has been developed for accessing the patient data or medical records in a secured way.

Keywords: Biometrics; Fingerprint recognition; authentication; pattern matching; templates

Introduction

Biometrics technology is used for measurement of the parameters which involves human characteristics. Realistic authentication is performed with the help of biometrics. This technology is defined as a source for identification and authentication process. Biometric systems can be divided into two with the physiological and behavioural characteristics. Physiological characteristics describe the body features like fingerprint, iris scanner and DNA printing. These physiological characteristics can be subdivided into biological and morphological features. Behavioural characteristics are defined to behaviour of person which includes type rhythm, gait state and voice recognition [1]. The main application of Biometrics is used for security and access entry.

Characteristics of biometrics to be considered in designing the technology are

- Universal – should be used by everyone
- Unique – distinguishable features among two individuals
- Invariable - should not change with any aspect
- Recordable – should be analysed, collected and stored
- Measurable – can be defined and measured.

Biometric identification is fast and easy method traditionally used in computer field for data security and authentication. Before biometric systems, security concerns were analysed by two types of systems namely knowledge based which indicates the passwords and token based indicates ID or access cards. Later biometric technology based systems are designed which are more effective when compared with the previous systems. The biometric system involves the major modules such as image capturing module, feature extraction module, pattern matching module. The image capturing module consists of raw data of any individual. Feature extraction module extracts and stores template of the individual’s characteristics. Pattern matching compares extracted feature with stored template for access or authentication [2]. Different patterns of biometrics are determined by different ways.

One among the biometrics is Fingerprint Recognition which is based on location and direction of ridge endings and splits along the ridge path. The two commonly used Fingerprinting methods are minutiae based matching and pattern based matching. Fingerprint recognition refers to match between same individual’s fingerprints. Because of unique nature of fingerprints this is used throughout the world for security issues and advanced technology in biometrics are defined to be fully automatic. The Fingerprint is formed at seven months of
foetal development during the gestation period which is unique for each and every individual. Fingerprint pattern exhibits different types of feature such as global level, local level, very fine level. Global level when ridges are parallel. Local level when ridges are discontinues. Very fine level when ridges are cross ever.

Three principles of fingerprint which defines fingerprint to be efficient biometric technique are

- Individual characteristics
- Remains unchanged
- Variable ridge pattern

The Fingerprint patterns can be categorised as plain whorl, right loop, arch, tented arch, accidental loop, ulnar arch, radial loop, central pocket loop and double loop. The performance of the fingerprint recognition can be improved by applying image enhancement techniques that increases the resolution of the input images.

Biometric technology based on fingerprint recognition is used in various applications such as network sharing, access to secure areas and protected resources, remote financial transactions, in commercial flights during boarding and so on. These applications are mainly based on the verification and identification of the individual’s identity in different sectors. These technologies highly concerned with security and privacy of the confidential resources.

In healthcare, patient or medical records are defined to be highly confidential which has to be secured. Biometric technology is implemented in patient record maintenance that provides access to only few physicians and medical technicians. Hospitals are interlinked through networks, therefore transfer of medical data for diagnosis purpose are also secured through biometrics. Biometrics is applied for highly protected resources that are secured through the process identification, verification and authentication. Fingerprint technology defined to be less complex compared to other technologies in biometrics. The use of fingerprint technology in the field of healthcare and different fields are discussed below.

**Literature Survey**

**Study on Biometric approach–Fingerprint Recognition:** Ravi Subban.et.al explains the performance analysis of fingerprint biometric system [2]. The evaluation of performance is done on survey works with different parameters such as False Rejection rate and False Acceptance rate. Biometrics is presented to be advantageous over passwords and token based security. The security and privacy concerns in various fields are associated with biometric authentication. The raised needs of the technology have to be addressed. Use of the different patterns of fingerprint for authentication, identification and verification is compared based on the acceptance and rejection rate. Automatic fingerprint recognition is defined to be more advanced technology for explosive security, usability, size, privacy and operational room temperature range.

**Minutiae matching in Fingerprint Recognition:** Manisha Redhu et.al describes that fingerprint recognition is used as form of biometric to analyse human data. The study involves stages of minutiae extraction from fingerprint to minutiae matching which produce match score. Various standard techniques are used for processing of the minutiae patterns. The low percent of verification indicates that algorithm used in not very robust and is vulnerable to effects like elastic deformation. A major problem in fingerprint recognition is the pre-processing of bad quality of fingerprint images[5].

**Combination of Minutiae and LDDS features for absolute performance:** Rahul sharma describes the survey performed on fingerprint recognition system. The fingerprint is a physiological biometric characteristic to identify a person or individual. Classes of fingerprint are defined based on the basic patterns like arches, loops and whorls. The experimental results shows that the consequences function can lead to a substantial improvement in performance of the fingerprint biometric system[6]. Two methods are defined, first in which the samples are taken in random manner followed by a two dimensional Discrete Wavelet Transform (DWTs) and in second, the fist is considered and the RGB conversion is performed. Manual based human experts use a combination of visual, textural, minutiae cues for identification and verification. Because of their uniqueness and consistency over time, fingerprints have been used for identification over a century, more recently becoming automatic in nature. As a result, LDDS (Long Digital Straight Segments) which is a best technology compared to orientation field. This paper shows the combination of the minutiae and LDDSs features that gives the better performance as compared to minutia based method.
Fingerprint image > binarization > block filter > minutiae extraction > minutiae matching > matching score

**Fingerprint biometric system with DFT and NDA Classification:** Y. Faridah et al., describes on fingerprint biometric system. Fingerprint system is used because it is smaller in size and has low consumption of power. Minutiae-based and Euclidean distance based technique is used in general for fingerprint biometric system. Sensor captures biometric data in digital format. Results are controlled by EER, FAR & FRR (EER – Equal Error Rate, FAR-false acceptance rate, and FRR-false rejection rate). The image captured is saved in data form. A new way of fingerprint classification is defined by using Discrete Fourier Transform (DFT) and Nonlinear Discriminant Analysis (NDA) [7]. Image processing algorithms described for Fingerprint biometric system are based on the application where it is used. The fingerprint system is popular biometric technologies. The fact that every person has a unique stamp fingerprints helped cost system as compared to other biometric technologies.

**Biometric systems: emerging techniques and scenarios:** Genovese et al., illustrates that Biometric technology is a system of ensemble devices and algorithms for recognition and identification of the persons through physiological and behavioral characteristics automatically. Traditionally biometrics are used in security applications and in recent advancements these technologies are used in non-ideal sample conditions and performance in real time. Biometric technology used in different applications in public, government and user-based systems [8].

**Wireless body sensor network (WBSN) with low power adaptive process for biometrics and healthcare applications:** Shih lun Chen et al., defines the use of wireless body sensor network of four levels of hierarchy for designing biometrics and also for applications in healthcare. This makes two separate ways which discriminates communication and control. Communication cycle is introduced to improve efficiency of the system. Low power process which is adaptive is defined for long time monitoring in healthcare [9]. Thermal sensor nodes with different specifications like a micro control unit (MCU), a thermal bipolar junction transistor sensor, an analog-to-digital converter (ADC), a calibrator, a data encoder, a 2.4-GHz radio frequency transceiver, and an antenna. These thermal sensors are used for detecting ECG from ten individuals and which is used for processing with the WSBN technology. With these technologies interfaced the transmission and reception of the signals occurs along with these biometrics is added to secure the data while transmission and reception of ECG signals.

**Physiological Signal Based Authentication for Body Area Sensor Networks and Mobile Healthcare Systems:** Shu Di Bao et al., describes the m-Health which is an evolutionary change in the field of biomedical technologies. Sensors in biomedical is either implanted or worn over in an individual for monitoring healthcare and also for easy diagnosis and early treatment. Sensors are designed in such a way that they possess wireless body sensor network areas to maintain privacy during transmission of data. The main aim is to describe a solution to the problem of authentication of the user in m – Health. Bio signals obtained using these sensors are used for two major applications. One is for specific healthcare application and the other is sensors can be used along with wireless technology for biometric system designing [10]. Photoplethysmogram (PPG) signals are derived from different parts of the body for 12 healthy individuals. Heartbeat interval used as characteristic in biometric technology to identify, verify and authenticate an individual. Statistical analysis is perfomed to define that the heart beat interval can be used as an feature of biometrics for authentication with the help of body sensor networks.

**Conclusion**

In this paper, the biometric system technique is illustrated briefly. Applications of the biometric system in different fields are defined. Among the biometric technology, fingerprint based recognition is described to be more common and frequently used way of identification, verification and authentication. Fingerprint technology is unique, simple and cost effective. Template designing and matching is comparatively possible with simple image processing algorithms. Template matching depends on the patterns of the fingerprint. The biometric system designed functions based on the template formed which is based on these patterns defined.

Fingerprint technology has various applications to secure the resources and authenticate only authorized personnel’s to access these resources. Biometric technology is also interfaced with the Internet of Things.
(IoT) for transmission of data that is to define who access the secured resources and any defect or functional misuse can also be detected and the security of the information can be increased [11]. Fingerprint technology also used in healthcare to secure the patient details and medical records. In hospitals, access to these records is provided only to higher officials who handle these data in a secure way.

Medical ethics illustrates serious problems like confidentiality and privacy, conflicts of interest, harm to patients and the state of nature of the relationships between the physician and the patient which need to be balanced between potential benefits and harm. Biometrics technology is used in two different ways. One is identification or description of terrorists can be electronically circulated to all areas with high risk factors for prevention that is biometrics can be used for protecting the nation from bioterrorism. Second is detection and identification of diseases to reduce the death rate by providing early warning to the biological attacks, this is especially concerned with public health[12].

Biometrics is used in various applications and also used in medical informatics fields for maintaining records. Access to Picture Archiving Computing Systems (PACS) is also governed with the help of biometric technology [13]. Biometric sensors are used in different healthcare equipment’s for privacy and security of healthcare record systems and management [14]. The management of the biometrics helps in providing a highly secured environment for the confidential resources or data. 3D Face Analysis can be determined for the biometric technology. The sensors in biometric technology define the 3d model structures of face in dimensions as biometric for accessing healthcare [15]. Mobile network base biometric technology is also designed for maintaining and accessing records of healthcare using finger vein technology[16]. Biometric technology is used in different applications in healthcare especially for medical images and health records accessing. Security of these data or images is mandatory because misuse of these records is illegal. In biometrics, fingerprint is the most commonly and frequently used unique technology. Therefore, fingerprint biometric technology possesses various applications in healthcare.

**Future Scope**

Based on the review study defined, a new module for analyzing the fingerprint patterns are designed and used for the authentication of the medical records in hospitals. The module designed in such a way that transfer of patient records within the hospitals are also authorized using biometric systems.

**Ethical Clearance:** This Study does not require Ethical Clearance. Since it is a review Study carried out in Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

**Source of Funding:** No source of funding is required for the review study conducted.

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Effect of BMI on Lower Limb Muscle Coactivation During Leg Strengthening exercises

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ABSTRACT

The lower limb muscles and joints are major contributors for locomotion, body stability and weight bearing. The important Lower limb joints are Hip Joint, Knee joint and Ankle joint. Muscles attached with these joints control the joint movement. Simultaneous activation of muscles around the joint helps them to move and perform tasks. This coordinated activity of muscles is called Muscle Coactivation. There are factors affecting the stability of joints such as aging, body weight and pathology. The purpose of this work is to investigate the effect of Body Mass Index (BMI) in the lower limb muscle coactivation during Leg strengthening exercises. Agonist muscles are those that contribute major for a movement whereas antagonist muscles control or oppose the agonist action. Quadriceps-Hamstrings and Gastrocnemius-Tibialis anterior are the agonist-antagonist pairs that predominantly contribute towards knee joint and ankle joint movement and stability respectively. The Electromyogram (EMG) is a major tool for studying the muscle activity and function. Maximum Voluntary Contraction (MVC) for each muscle group is performed with a standard protocol where the contraction by the muscle group is obtained. The physical activities are chosen in such a way that it contributes towards individual muscle groups. EMG recorded during activity is normalised with the MVC and the coactivation between the agonist-antagonist pairs shall be obtained. This analysis helps in improving the exercise patterns for rehabilitation and can also be used in injury prevention programs.

Keywords: BMI, Muscle Coactivation, Maximum voluntary contraction, Strengthening Exercises

Introduction

Around 70% of Indian population between the ages 45 – 60 have knee joint disorders and the rate of knee replacement surgery has increased to 61%. There are three major joints such as Pelvic joint, knee joint and ankle joint along with the lower limb muscles are involved in locomotion, stability and the orientation of the body movement. The coordinated activity of the lower limb muscles contribute towards the stability of the joints in the lower limb. For this stabilisation of the joint, coactivation of the corresponding muscles play an important role. The simultaneous activity of the muscles over a joint is known as Muscle Coactivation [1]. Co-activation occurs during normal movement patterns and may improve movement efficiency during the performance of lower limb activities with increased joint protection and stabilization [2]. Co-activation assists and stabilizes the ligament in the joints such as Anterior Cruciate Ligament [3]. This simultaneous activity is performed by the agonist and antagonist muscle pair. Quadriceps–Hamstrings and Gastrocnemius – Tibialis Anterior form the agonist – antagonist pair in the lower limb.

Age, Gender and Body weight of the person are considered to have strong impact on the parameters of the muscle strength and endurance [4, 5]. The coactivation tends to increase with age, reducing coordination and hence stability, leading to the potential for injury caused by accidents [6, 7]. Body weight is one of the important factors that affect the stability of joints [8]. This affects

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the normal movement patterns as the load distribution becomes uneven for people with increased body weight \[9\]. The purpose of this paper is to investigate the effect of body weight in the co-activation of lower limb muscles during leg strengthening exercises.

Surface EMG data of the muscles chosen is used as data for obtaining the co-activation of the agonist-antagonist muscle pair during the exercises. Surface electromyography (EMG) is useful in the study of human movement as it is a non-invasive method used for evaluating the timing of muscle activation and activation amplitude during walking \[10\], running and rehabilitation exercises \[11\], and as a measure of skeletal muscle fatigue\[12\].

Extrinsic factors like the electrode configuration and location are controllable, while intrinsic physiological factors like the amount of subcutaneous tissue, muscle fiber type, fiber diameter, and blood flow within the muscle cannot be controlled by the researcher. Due to these inherent problems associated with acquisition of the EMG signal, it is necessary to normalize the signal amplitude to a standard value when comparing different subjects, muscles, and studies, or conducting repeated measures across different testing sessions. Maximal voluntary isometric contraction (MVIC) appears to be the most common normalization method used \[13\]. 8 muscles from the lower limb were chosen and they are Rectus Femoris, Vastus Medialis and Vastus Lateralis from the Quadriceps group, Bicep Femoris and Semitendinosus from Hamstrings group, Gastrocnimus Medialis and Gastrocnimus Lateralis from Gastrocnimus group and Tibialis Anterior.

Methodology

Data Acquisition: Fifteen healthy females (N = 10, age: 23 ± 2.5 years), volunteered to participate in this study. The volunteers are students from various disciplines in Anna University. Since the aim of this work is to analyse the effect of Body Mass Index (BMI) in the lower limb muscle coactivation, subjects with BMI range from 17.5 to 30.5 were chosen. BMI is calculated from the formula,

\[
\text{BMI in kg/m}^2 = \frac{\text{Body weight in kilogram}}{(\text{Height in meter})^2}
\]

Subject informed consent was taken prior to the participation in the experiment. All EMG data were collected in a single testing session from the muscle pair chosen on the dominant limb of the subjects.

Procedure: Bipolar EMG electrode with 10mm inter electrode distance was used for acquisition. Before the acquisition of EMG signal, the participants were educated about the entire experimental procedures in detail. Initially participants were asked to do treadmill walk for 5 minutes to warm up.

Figure 1: Flow Diagram of EMG signal acquisition and processing

Figure 1 shows the work flow of the entire process. 8 bipolar surface EMG electrodes were placed on the subject’s dominant leg on the selected muscles according to the SENIAM guidelines \[14\]. Before placement, electrode sites were prepared by shaving hair from the immediate vicinity of the muscle belly and cleansing the skin with isopropyl alcohol to reduce impedance to the EMG signal and to allow proper electrode fixation. The electrode is placed on the midsection of the muscle belly of each muscle as shown in figure 2.

Fig 1: Flow Diagram of EMG signal acquisition and processing

Fig. 2: EMG Electrode Placement

Maximum Voluntary Contraction (MVC) for the muscle groups were performed by the subjects against the gravitational force. The Maximum Voluntary Contraction is a measure of strength or force exerted to the maximum by the subject. MVC was done with 3 trials for each procedure. Data from the MVC procedure is used for normalisation procedure.

MVC for Hamstrings muscle group is performed while the subject is placed in prone position and the dominant
leg knee is flexed against strap tied around the leg. For Quadriceps muscle group, MVC procedure is seating the subject on the chair erect and the knee is extended against the strap tied. During the MVC procedure of Gastrocnimus muscle group, the Toe of the subject is placed over a fixed board and the board is pushed with maximum force. Toe raise is performed as MVC procedure for Tibialis anterior muscle. The strength is checked with the myometer for each MVC procedure and the EMG is recorded while the procedure is done.

The leg strengthening exercises were chosen in such a way that muscle pairs selected contributes during the exercises and are well involved. Squatting, Toe walk (plantar flexion) and Heel walk (dorsi flexion) are the exercises subjects instructed to do while recording EMG.

**Data Processing:** EMG data was acquired at a sampling rate of 1000Hz. EMG data for every exercise was recorded for 5 trails. The raw EMG signal was filtered using notch filter with 50Hz to remove noise interference and bandpass filter with 20-500Hz to remove other noises. Butterworth bandpass filter is used here and the signal is rectified. RMS envelope is plotted for the rectified signals using windowing technique.

\[
RMS = \sqrt[\frac{1}{T-t}]\sum_{t}^{T} X^2
\]

This peak RMS from each MVC signal of the respective muscle group is calculated for all the subjects. The peak RMS values for the EMG of the exercises performed were obtained. Electrogoniometer data is used as reference to the EMG data of the exercise pattern.

The peak average RMS of the exercise EMG signal is normalised to the MVC-RMS for each muscle group. Figure 2 shows the normalised EMG signal of the chosen muscle group during the exercises.

The normalised RMS value for each muscle is tabulated and the co-activation ratio is calculated by,

\[
\text{Coactivation Ratio} = \frac{\text{Mean RMS (Agonist)}}{\text{Mean RMS (Antagonist)}}
\]

**Results**

The co-activation ratio is calculated with respect to the muscle group being agonist and antagonist in action. The Squatting, signals are used to calculate the co-activation ratio of Hamstrings-Quadriceps (H:Q) muscle group and Toe walk and Heel walk signals are used to calculate the co-activation ratio of Gastrocnimus-Tibialis Anterior (G:T) muscle group.

Table 1 shows the coactivation ratio between quadriceps and hamstrings muscle group while squatting. This table shows changes in the coactivation ratio with the changes in the BMI of the corresponding subjects. Standard deviation (SD) for the coactivation ratios among the 10 subjects for squatting was ± 1.5. This says squatting shows higher variation i.e., Quadriceps and Hamstrings muscles show higher variation with the BMI for these exercises from Figure 5.

Table 1, also shows the coactivation ratio between Gastrocnimus muscle group and Tibialis Anterior during Toe walk and Heel walk. Similarly, the SD of the coactivation ratios for Toe walk and Heel walk is ± 1.6 and ± 0.8 respectively. This shows contribution of Gastrocnimus and Tibialis Anterior show higher variation with BMI for Toe walk than Heel walk from Figure 6 & 7.
Table 1: Estimated Coactivation Ratio between the muscle group during leg strengthening exercises

<table>
<thead>
<tr>
<th>Subject</th>
<th>BMI in kg/m²</th>
<th>Coactivation Ratio</th>
<th>Between Quadriceps and Hamstrings Group</th>
<th>Between Gastrocnemius &amp; Tibialis Anterior</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Squats</td>
<td>Toe Walk</td>
</tr>
<tr>
<td>1</td>
<td>29.5</td>
<td>4.8</td>
<td>4.9</td>
<td>4.3</td>
</tr>
<tr>
<td>2</td>
<td>26.5</td>
<td>5.3</td>
<td>6.2</td>
<td>1.8</td>
</tr>
<tr>
<td>3</td>
<td>27.1</td>
<td>4.2</td>
<td>7.1</td>
<td>2.8</td>
</tr>
<tr>
<td>4</td>
<td>30.5</td>
<td>6.1</td>
<td>5.2</td>
<td>4.2</td>
</tr>
<tr>
<td>5</td>
<td>24.6</td>
<td>4.8</td>
<td>5.6</td>
<td>4.1</td>
</tr>
<tr>
<td>6</td>
<td>19.4</td>
<td>3.4</td>
<td>2.9</td>
<td>1.3</td>
</tr>
<tr>
<td>7</td>
<td>17.5</td>
<td>3.1</td>
<td>3.1</td>
<td>2.7</td>
</tr>
<tr>
<td>8</td>
<td>18.7</td>
<td>3.4</td>
<td>3.4</td>
<td>3.3</td>
</tr>
<tr>
<td>9</td>
<td>20.3</td>
<td>3.5</td>
<td>4.1</td>
<td>3.6</td>
</tr>
<tr>
<td>10</td>
<td>22.1</td>
<td>3.0</td>
<td>3.3</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Fig. 5: Coactivation Ratio (Q:H) Variations during Squatting,

Fig. 6: Coactivation Ratio (G:T) Variations during Toe Walk

Fig. 7: Coactivation Ratio (G:T) Variations during Heel Walk

There are random variations in the coactivation ratios among the subjects as shown in Figures 5, 6 and 7. While comparing the ratio with the subject’s BMI, subjects with higher BMI showed higher coactivation ratios during Squatting and Toe walk significantly as shown in the Table 2 and 3.

Table 2: Comparing the Coactivation (Q:H) with BMI

<table>
<thead>
<tr>
<th>BMI</th>
<th>Coactivation Ratio (H:Q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squatting</td>
<td>27.64 ± 2.4</td>
</tr>
<tr>
<td></td>
<td>20.72 ± 1.7</td>
</tr>
</tbody>
</table>

Table 3: Comparing the Coactivation (G:T) with BMI

<table>
<thead>
<tr>
<th>BMI</th>
<th>Coactivation Ratio (G:T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toe Walk</td>
<td>27.64 ± 2.4</td>
</tr>
<tr>
<td></td>
<td>20.72 ± 1.7</td>
</tr>
<tr>
<td>Heel Walk</td>
<td>3.44 ± 1.1</td>
</tr>
</tbody>
</table>

During squatting, the contribution of the quadriceps group and hamstrings group are significant. Hence, the coactivation ratio showed differences among the subjects with higher and normal body mass index. Toe walk showed significant changes in the coactivation ratio between gastrocnemius and Tibialis anterior among the subjects with normal and higher BMI.

Conclusion

We evaluated the Coactivation ratio of lower limb muscles during various leg exercises for 10 subjects. Squatting and Toe walk showed significant changes in
the ratio among these subjects. Whereas, heel walk did not show variations in the ratio significantly. The BMI of the subjects were also compared with the coactivation ratio, where the higher BMI subjects had higher ratio. Higher coactivation shows dominance of one muscle group during the action/exercise. This may affect the knee stability. Thus this shows that the BMI might have an effect on the lower limb muscle and knee stability. Also, coactivation ratio estimation can help in planning therapeutic and rehabilitation exercises for better progression in the patients.

**Ethical Clearance:** The Study is based on the EMG signal acquired during leg strengthening exercises. The Study was conducted on voluntary participation of healthy subjects and does not require Ethical Clearance. Informed Consent was obtained from the subjects. This Study is conducted in the Biomedical Instrumentation Lab of Centre for Medical Electronics, Department of ECE, College of Engineering Guindy, Anna University, Guindy, Chennai-600025.

**Source of Funding:** Not funded by any source.

**Conflict of Interest:** Nil

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Design of Biomimetic Limb for Restoring Hand Function of Partially Amputated People

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ABSTRACT

Biomimetic limbs have a tremendous demand for the partially amputee people. To increase their moral strength and easy way to perform daily works, researchers are putting lot of effort in the work efficiency of biomimetic limbs. Partial amputation generally refers to removal of parts of limb due to trauma, medical illness or surgery. This biomimetic limb helps such people to gain better psychological outlook in life. Most of the EEG and EMG prosthetic hands have several shortcomings such as low intensity, high cost and blocked them from practical realization. The present proposal proposes a novel method of providing a user friendly and cost effective device for partially amputated people. To overcome these problems the present work used flex sensors which can replicate the function of original hand using a hand glove placed over the working hand. The program of the device was done by using an Arduino microcontroller and to achieve the flexibility of up to 90 degrees servo motors were used. This novel device can help a partially amputated person to lead a normal life in society and gain his self-esteem. The cost of the device is three times low as compared to the marketed device which has less option and heavy weight. This cost effective device was designed with limited number of sensors and motors in order to achieve its compactness and it would also produce more number of hand movements much similar to the original hand.

Keywords: Biomimetic limb, Arduino microcontroller, servo motors, flexes sensors, more number of hand movements, cost effective

Introduction

Although electroencephalography (EEG) and electromyography (EMG) is extensively used in many research fields, these signals only give a coarse view of neural activity and muscle activity of human body. Amputation is the removal of a limb by trauma, medical illness, or surgery. There are many reasons an amputation may be necessary. The most common is poor circulation because of damage or narrowing of the arteries, called peripheral arterial disease. Severe injury, cancerous tumour, serious infection, neuroma are other causes of amputation. People who have lost a limb or parts of limb may choose artificial limbs with microprocessors that provide more precise control of movements. Prosthetic devices provide a greater sense of independence. People can gain a better psychological outlook on life by mastering the use of prosthetic limbs. The proposed project aims to design a biomimetic limb for partially amputated people which would make a difference to the victim and also boost his self-esteem and confidence. The aim of the project is to design a cost effective biomimetic device using limited number of sensors and motors. Attaining more effectiveness with less number of sensors is a major issue. it is also important to have a detailed study on operations and functions of amputated part.

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are used which are slippery, cause irritation on skin and which do not provide effective results. Researchers used minimum number of motorsthat limits the grasping action \(^2\). Several researches proposed a dynamic relationship between force and position \(^3\). Each finger of the hand was designed based on the coupling linkage principle and actuated by a DC motor individually but the hand was a bit noisy due to multiple numbers of gear stages. Pressure sensors were designed at the tip of each finger that provided similar sensing \(^4\). One of the main drawbacks was if the object contact doesn’t happen in the unit normal direction this force can be misinterpreted by the sensor.

The proposed proposal checks the effectiveness of each and every finger independently and provides more accurate output. The flex sensors help to mimic the functions of hand and it does not cause any pain or insecurity to the amputee. Moreover usage of five sensors and five motors improves the effectiveness and accuracy of the device.

**Methodology**

The initial step involved is material collection. Different acrylic pieces were collected to integrate the artificial hand. The artificial hand was made such that it appears similar to original hand. Designing the hand glove with flex sensors was the next important step. The prototype hand was designed with servo motors. Comparison and compilation of the working movement of the prototype based on hand glove was carried out. Providing the power supply to Arduino was done and verified. The Arduino was programmed and tested with respect to flex sensors. The values were standardised for effectiveness.

**Hardware Required**

**Prosthetic Hand System:** Mechanical design of the Prosthetic Hand was designed using human hand’s anthropomorphic characters such as the humanoid appearance, the power, and the weight, the grasp functionality etc. Hand’s humanoid appearance in its mechanical design is considered. The shape of palm and fingers and their positions are similar to that of human hand. The ultimate goal of the design was to develop a five-fingered hand that is lighter and cost effective, with totally built-in actuation mechanism. The fingers of the hand, which possess three phalanxes each, can be individually actuated.

**Arduino Uno:** Also known as ATmega328 has an operating voltage of 5V. It has 14 digital I/O pins of which 6 provide PWM output. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller. The hardware consists of a simple open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. “Uno” means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform.

**Sensory System:** Flex Sensor’ or ‘Bend Sensor’ is a sensor that changes its resistance depending on the amount of bend on the sensor. They convert the change in bend into electrical resistance—the more the bend; the more the resistance value. The Flex sensor patented technology is based on resistive Carbon elements. As a variable printed resistor, the flex sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius — the smaller the radius, the higher the resistance value. One side of the sensor is printed with a polymer ink that has conductive particles embedded in it. When the sensor is straight, the particles give the ink a resistance of about 30k Ohms. When the sensor is bent away from the ink, the conductive particles move further apart, increasing this resistance. When the sensor straightens out again, the resistance returns to the original value. By measuring the resistance, you can determine how much the sensor is being bent.

**Servo Motor:** This is normally a simple DC motor which is controlled for specific angular rotation with the help of additional servomechanism (a typical closed loop feedback control system). Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. When the sensor straightens out again, the resistance returns to the original value. By measuring the resistance, you can determine how much
the sensor is being bent. Servo motors are available in power ratings from fraction of watt up to few 100 watts. They have high torque capabilities. The rotor of servo motor is made smaller in diameter and longer in length, so that it has low inertia. Usually a servomotor turns 90° in either direction, i.e. maximum movement can be 180°. A normal servo motor cannot rotate any further due to a built-in mechanical stop. Three wires are taken out of a servo: positive, ground, and control wire. A servo motor is controlled by sending a Pulse Width Modulated (PWM) signal through the control wire. A pulse is sent every 20 milliseconds. Width of the pulses determines the position of the shaft.

Hand Glove: A glove is a garment made of woollen material which covers the whole hand. In this project the working hand is covered with a glove completely. Flex sensors are souldered and pasted over the glove for each finger independently

Software Required

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS and Linux. The environment is written in Java and based on Processing.

Result and Discussion

The proposed system was developed and tested for various degrees of freedom. Since the artificial hand consists of more number of joints, we are able to obtain better flexibility and good degrees of freedom. In the current scenario the patient has to remove his limb due to any accidental issues. Because of removal of limb or parts of limb the patient loses his moral strength as well as feels inferior and inconvenient in his day to day life. The proposed proposal has come up with better effectiveness and grasping ability of the artificial hand. The usage of minimum number of sensors and motors has improved the appearance and reduced the weight of the biomimetic limb. In future this system can be enhanced by designing a complete limb for stroke patients by limiting the number of sensors and actuators and also making it wireless. The system can be upgraded such that it can lift even heavy weights using pneumatic technology. The artificial hand was able to mimic almost the exact positions and movements of original working hand. The grasping ability of the hand was better than the previously proposed work. Several advancements were carried out in the field of prosthesis which has given a new ray of hope for the amputees. A Wearable mind controlled prosthetic hand was developed which had several limitations [5]. The results obtained were not effective as that of working hand. EEG sensors were used, which didn’t provide accurate results. Brain computer interface to enhance the control accuracy. Similarly a system was proposed with several mechanical designs which were similar to human hand. They were capable of lateral grasps and precise grasps. But the only limitation in this work was usage of limited number of motors [8].

Future Scope

The project can be extended in future by increasing the number actuators and thus improving the hand movements. It can be made compatible enough to lift heavy weights also.

Ethical Clearance: The Study is based on designing the limb using minimum number of actuators and sensors. The Study has been conducted by the guidance of Head of the Department, Ms.R.J. Hemalatha.

This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

Source of Funding: It is one of the Self-funding projects of Department of Biomedical Engineering.

Conflict of Interest: Nil

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IoT Based Ketoacidosis Detection

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ABSTRACT
Ketoacidosis also known as DKA (diabetic ketoacidosis) is a serious condition which occurs in patients who suffers from diabetes. It affects people above 25 years of age. It occurs due to insufficiency of insulin. Detection of ketone is done by the nitro prusside-based urinary dipstick ketone test and plasmalserum ketone analyses. Non-invasive detection of ketoacidosis is done by breath analyzer. In this paper we are using breath acetone as a biomarker for ketoacidosis. The resultant ketoacidosis values are transmitted through ESP8266. The ESP8266 sends the sensor values to think speak (private cloud). The new channel is created in Think Speak private clouding and Channel API keys are generated to read and write the sensor data from ESP8266. Through this simple IoT device the physician is always connected to the patient and can be able to monitor the ketoacidosis condition of the subject

Keywords: ketoacidosis, think speak, IoT, API keys

Introduction
Ketoacidosis is related to concentration of ketone bodies which are high. The human produced ketones are of two types such as acetoacetic acid and β-hydroxybutyrate. It causes accumulation of keto acids and pH change in blood. It mainly occurs in type 1 diabetes mellitus patients but also seen in type 2 diabetes mellitus. No proper treatment of ketoacidosis can lead to coma or fatal. In this paper ketoacidosis data is acquired and transmitted to doctor via internet.

The condition called as Diabetes Mellites which is a great threat to the healthcare and its detection in noninvasive is rare methodology.1 The Diabetic patients does not produce enough insulin, the fat molecules stored in the body is converted as energy. If the fat is converted as ketones, then it produces the acetone. Hence the acetone can be used as biomarker for the detection of Ketoacidosis condition2 and the hydrogen Sulphide can be used as biomarker for detection of Halitosis4 condition. The diabetic patients have sweet odor in the breath because of acetone mixed with the exhalation of the patients

Diabetic ketoacidosis (DKA) is a buildup of acids in your blood. It can happen when your blood sugar is too high for too long. It could be life-threatening, but it usually takes many hours to become that serious. You can treat it and prevent it, too. It occurs when the body doesn’t have enough insulin. The cells can’t use the sugar in their blood for energy, so they use fat for fuel instead. Burning fat makes acids called ketones and, if the process goes on for a while, they could build up in the blood. That excess can change the chemical balance of blood and throw off the entire system. People with type 1 diabetes are at risk for ketoacidosis, since their bodies don’t make any insulin. DKA can happen to people with type 2 diabetes, especially in older people

In human breath, diverse components are found including water vapor, hydrogen, acetone, toluene, ammonia, hydrogen sulfide, and carbon monoxide, which are more excessively exhaled from patients. Some of these components are closely related to diseases such as asthma, lung cancer, type 1 diabetes mellitus, and halitosis. Breathe analysis for disease diagnosis started from capturing exhaled breaths in a Tedlar bag and

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subsequently the captured breath gases were injected into a miniaturized sensor system, like an alcohol detector. It is possible to analyze exhaled breath very rapidly with a simple analyzing process. The breath analysis can detect trace changes in exhaled breath components [8], which contribute to early diagnosis of diseases [10] to the system for detecting halitosis that comprises a gas sensor for generating a sensor signal signaling the detection of compounds indicative of halitosis exhaled through an oral cavity, an image sensor for capturing an image of a dental condition and/or tongue condition in said oral cavity and a processor communicatively coupled to the gas sensor and the image sensor and adapted to process the sensor signal and the image in order to determine if in case of the sensor signal signaling the presence of a compound indicative of halitosis, said halitosis originates from said oral cavity by determining the dental condition and tongue condition in said image. Thus, the result states it 85% accurate to the gas chromatography.

A non-invasive breath test to monitor the condition of diabetic patients where it is identified as an easier technique and quick diagnoses of diabetic ketoacidosis that prevent acute complication of type 1 diabetes mellitus. A method of monitoring ketone level by using breath measurement is done. An easy handheld health care on monitoring diabetic level with breath is presented. Method presented a development of hardware connection with Internet of Things (IoT) system to facilitate the process of patients’ diagnosis and personal monitoring. An Arduino board is used to read the sensor with sense the breath. Breath value level is log to system using wireless communication. Data collection is interfaced to web page. Ketone level is measured as the amount of breath acetone is collected when patients exhale into a mouthpiece that consists of gas sensor. This research is identified as a significant research where patients can independently monitor their diabetic health and the IoT system can be alerted directly to medial officers in the hospitals. The analysis of ketone level from the breath is based from the resistance of the gas sensor. FIGARO TGS 822 gas sensor is used to detect the amount of gas acetone in a person’s breath. When the concentration of the acetone gas increases, the resistance of the sensor is decreased. The decrease of resistance is depending on the three factors; gas concentration, humidity and temperature. To get an accurate concentration of acetone gas in a person’s breath, humidity and temperature sensor (DHT11) is added. This is due to the sensitivity of the electrochemical gas sensor towards other gasses other than acetone. As the reading from sensor is sent to Arduino, the data is shared to the database via Wi-Fi module ESP8266. ESP8266 gives Wi-Fi networking with TCP/IP protocol stack which can give Wi-Fi connection to Arduino board so that the data can be processed and shared to the web database. Thus the result shows that the amount of breath acetone method to determine the ketone level of diabetic patients is applicable as there is a good correlation between breath acetone levels and blood ketone levels developed a new generation of diagnostics for halitosis, replacing the subjective organoleptic assessment, a series of exhaled breath analyzers has been developed and assessed. All three devices rely on the assessment of exhaled Volatile Sulfuric Compounds (VSCs), which are mainly generated in and emitted from the oral cavity, contributing to the malodor. Portable, on-site and easy to use, these devices have potential for non-invasive diagnosis of halitosis. However, global assessment of exhaled VSCs alone has two main drawbacks: (1) the absence of VCSs does not rule out halitosis; (2) non-sulfuric volatile compounds that could be biomarkers of systemic diseases, found in up to 15% of halitosis cases, are neglected. The field of oral/exhaled volatile compounds as potential noninvasive diagnostics for halitosis. Thus, cross-reactive (semi-selective) sensors are used to analyze patterns qualitatively. the system is not capable of quantitative analysis or identifying the exact VOCs/VSCs in a given sample. Therefore, prior to the clinical phase, it is critical to study the identity of the targeted compounds in vitro and in vivo, by chromatography and spectrometry. In addition to this, a wide database of breath samples from oral and extra-oral halitosis patients should be used for clinical validation of the sensors for use as a database of pattern references that the software would use to match the pattern and classification of each newly obtained breath sample.

Proposed an apparatus for detecting and separating specific compounds in breath gas mixtures for halitosis analysis consisting of a line for delivering a pressure-controlled neutral gas; a removable connected sample chamber of specific volume for receiving the gas mixture to be evaluated; an electronically controlled valve for injecting the gas sample into the line a temperature-controlled micro-fabricated separation capillary column arranged to receive the gas sample injected into the line, a gas sensor at the outlet of the capillary column
and a control interface for managing the measurement and evaluating the obtained data. Sensitive detection of acetone and hydrogen sulfide levels in exhaled human breath, serving as breath markers for some diseases such as diabetes and halitosis, may offer useful information for early diagnosis of these diseases. Exhaled breath analyzers using semiconductor metal oxide (SMO) gas sensors have attracted much attention because they offer low cost fabrication, miniaturization, and integration into portable devices for noninvasive medical diagnosis. However, SMO gas sensors often display cross sensitivity to interfering species. This work reports on highly sensitive and selective acetone and hydrogen sulfide detection achieved by sensitizing electrospin SnO2 nanofibers with reduced graphene oxide (RGO) nanosheets. SnO2 nanofibers mixed with a small amount (0.01 wt %) of RGO nanosheets exhibited sensitive response to hydrogen sulfide (Rair/Rgas = 34 at 5 ppm) at 200 °C, whereas sensitive acetone detection (Rair/Rgas = 10 at 5 ppm) was achieved by increasing the RGO loading to 5 wt % and raising the operation temperature to 350 °C. The detection limit of these sensors is predicted to be as low as 1 ppm for hydrogen sulfide and 100 ppb for acetone, respectively. These concentrations are much lower than in the exhaled breath of healthy people. This demonstrates that optimization of the RGO loading and the operation temperature of RGO–SnO2 nanocomposite gas sensors enables highly sensitive and selective detection of breath markers for the diagnosis of diabetes and halitosis. The result was highly selective and remarkably sensitive sensors to H2S and acetone were produced by mixing SnO2 NFs with RGO NSs. The SnO2 NFs were produced by electrospinning, a simple and versatile method for the fabrication of NFs of different materials. Subsequently the SnO2 NFs were mixed with GO NSs at loading levels of 0.01 or 5 wt % GO, and eventually the GO NSs were reduced to RGO by annealing in forming gas. This resulted in porous nanocomposite layers of SnO2 NFs mixed with RGO NSs. At the small RGO loading level (0.01 wt %) the electrical transport and gas sensing properties of the nanocomposite layer were dominated by the SnO2 NFs, but at the high loading level (5 wt % RGO) the RGO NSs formed continuous percolation pathways and they became the dominant component controlling the electrical transport through the nanocomposite layer. This enabled tuning the gas sensing characteristics of the RGO NS–SnO2 nanocomposite sensors to achieve enhanced sensitivity and selectivity to traces of H2S or acetone in humid air for sensors with low or high levels of RGO loading, respectively. Besides changing the RGO/SnO2 ratio we also found that tuning the operation temperature of the sensors enabled achieving high selectivity between H2S and acetone.

**Methodology**

The subject blows into the gas chamber which contains temperature and humidity sensor (DHT-11) and gas sensor (MQ-138). The gas sensor measures the concentration of acetone gas in the chamber and the temperature and humidity sensor measures the temperature and humidity of the chamber. The sensed data is sent to the Arduino uno. The microcontroller processes the output and displays it in the LCD. The microcontroller sends the output to the ESP8266 and is uploaded in the internet in real-time.

**MQ-138 Formaldehyde Sensor:** The MQ-138 sensor is used to detect the acetone from the forceful blow of patient breath. The sensor is placed in a gas chamber where based on the gas concentration the acetone range is detected and displayed in serial monitor and LCD. This sensor can also detects Aldehydes, alcohols, ketones, aromatic compounds which are volatile compounds

**DHT-11 Temperature and Humidity Sensor:** The DHT-11 is a digital temperature and humidity sensor from micropik. A capacitive humidity sensor and a thermistor to measure the surrounding air is used which ranges from 20-90% with a resolution of 1°temperature from 0-50°C with a resolution of 1 at accuracy of 2°C

**ESP 8266 WIFI Module:** The ESP8266 microcontroller is integrated with a Tensilica 32-bit processor, which reaches a maximum clock speed of 160 MHz. The RTOS and Wi-Fi stack allow about 80% of the processing power to be available for user application programming and development.

**Thing Speak:** Thing speak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thing Speak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates.

**Gas Chamber:** The gas chamber contains two sensors. One is gas sensor and another one is temperature sensor.
The gas sensor is designed similar to gas chamber. The dimension of the gas chamber is 255cm³. The gas chamber in this project can hold up to ppm of acetone gas.

**Results and Discussion**

The Ketoacidosis condition is a pathological condition in which it is important to monitor regularly for the diabetic patients. In this paper the noninvasive method of monitoring the ketoacidosis is designed using the gas sensor. The gas sensor is placed in the gas chamber with that of Digital temperature and humidity sensor. The subject is guided to blow into the gas chamber, based on the gas concentration of acetone inside the chamber the acetone ppm values are displayed in the LCD as well as serial monitor and the acetone values are transmitted to the Thing Speak cloud individual private channel using ESP8266 (via API key). The ketone, temperature, humidity values are plotted in Thing speak web channel in real time. The real time plotted values are monitored by the physician and it is easy to get connected with the patients online. The recent trends in IoT development makes the patient get connected with the physician. The subject used to test for ketoacidosis conditions are diabetic as well as non-diabetic. The subject 1,2,3 are healthy individual and subject 4 and 5 are diabetic individuals. The subject 4 and 5 exhibit abnormal acetone values because all the subject has undergone two hours of fasting and acetone values are measured. For diabetic subjects the stored fats are converted into ketone bodies and that ketone bodies produces acetone, if food is not taken at proper intervals, that’s why the diabetic subjects always have fruity odor in their breath. This methodology is very helpful for noninvasive monitoring of ketoacidosis than measuring invasively by blood and urine. The work is then extended in future by making it very compact and mobile application-based monitoring and guiding the diabetic subjects for proper ketogenic diet.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject</th>
<th>Age</th>
<th>Acetone Value in PPM Per Litre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject 1</td>
<td>45</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Subject 2</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
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<td>Subject 3</td>
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</tr>
<tr>
<td>5</td>
<td>Subject 5</td>
<td>44</td>
<td>21</td>
</tr>
</tbody>
</table>

**Table 1: Acetone values of the subjects**

**Ethical Clearance:** The Study is based on the Digital Processing of the sensor and its connectivity via IoT (Internet of Things). The Study is been conducted by the guidance of Head of the Department, Ms.R.J.Hemalatha.

This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

**Source of Funding:** It is one of the VISTAS Internal SEED GRANT project of Department of Biomedical Engineering.

**Conflict of Interest:** Nil

**REFERENCE**


Smart Aid for the Blind

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ABSTRACT

The assist device for blind people is much needed in recent days. The gadgets in recent trends are digitized that the blind people are not capable of handling digitized applications hence in our project we design text to voice converter, that converts the eBooks, audiobooks to voice format. In this project the audiobook eBooks are fed into SD card reader after that the sd card reader is interfaced and the Arduino UNO converts the text file to Audio output. The audio books can be heard in headphone/speaker using Arduino UNO. This project is low cost it will be more useful for blind people.

Keywords: Braille; Arduino Uno; SD card module, jump wire

Introduction

The Braille Displays, Books, Gadgets are the best companion for the Blind people. In order to make them ease in reading any text, the Braille pattern books are developed. In recent days the Braille Electronic Keyboards, Braille Display Electronic Gadgets are available for the Blind people. In this project we propose an idea of making a smart Braille device in which it can able to read any e-books and convert the text to voice format. This smart Braille device will be a best companion for the blind people. The objective our study is to assist the visually impaired people with reading text and converting text into audio format using microcontroller at low cost and more reliable

Literature Survey:

Teaching interface of finger braille teaching system using smartphones finger braille teaching system between non-disabled senders’ deaf blind receiver has been developed- single column teaching interface for more easily viewable double column teaching interface promoted better performance (response time dotting speed and accuracy) using smartphone component - deafblind, finger braille, teaching interface, smartphone[2]

Braille based mobile communications translations glove for deaf blind people the literate deaf blind population, into text and vice versa, and communicates message via SMS to remote contact it enables to convey simple message by capacitive touch sensor input sensor placed on palmer side of glove and converted to text by PC/smartphone added min vibrational motor-assistive technology; braille; deafblind; haptic; human computer interaction ; mobile communications; sensory impairments; wearable device.[3]

Smart reader for visually impaired - OCR- the optical character recognition functions of MATLAB for converting image to text this paper proposes smart reader system for visually impaired here proposed novel audio tactile user interface that supports user to read information, component -MATLAB, OCR, text to speech, Web cam[4]

Methodology

The usage of electronic gadgets by the blind people when compared to the normal people is low because
of its in-accessibility. Most of the electronic gadgets are created for the use and easy access of the normal & healthy people whereas the blind people cannot be able to access the electronic gadgets easily, voice recognition in mobile based application will be more helpful to the blind people \[12,13\]. The blind people cannot be able to read an e-book or any e material It is very important to develop electronic gadgets for blind people with universal design. Voice recognition will be more helpful for blind \[5,11\]. The universal design plays important role in day to day life of the blind people. It is the primary responsibility for the society to create an easy and comfortable environment that are usable by all kind of people braille will be much more helpful in reading books for the blind \[7,12\]. The people with low vision or poor vision should also be considered as a user of electronic gadgets and the devices should strictly follow the universal design protocol for the easy access by the blind and low vision people. IOT are the recent in connecting blind people with technologies \[13\].

**Hardware Required:** The Arduino Uno is an open source microcontroller board based on the microchip ATMEGA328P microcontroller and developed by Arduino Uno the board is equipped with sets of digital and analogue input/output pins that may be interfaced to various expansion board and other circuit the Arduino guanine board, or other microcontroller. The ATMEGA328 provide UART TTL (5v) serial communication, which is available on the digital pin 0(RX) and (TX) an ATMEGA16 U on the board channel this serial communication over USB and appears as virtual com port to the computer software.

SD card module mostly useful for projects that require data logging the Arduino can create file in an SD card to write and save data using SD library there are different models from different supplier but they all work in similar way, using SPI communication protocol the module used in the tutorial The module comes with voltage regulator therefore the Arduino 5V and 3.3v pin can be used for voltage supply the modules communicates via SPI (serial peripheral interface) to the Arduino Uno.

**Software Required:** The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS and Linux. The environment is written in Java and based on Processing.

**Result and Discussion**

In this study the SD card reader is interfaced with the Arduino Uno. The Pdf file is fed into the SD card reader and the Arduino converts the text file to audio format. Pulse Width Modulation, or PWM, is a technique for getting analog results with digital means. The speaker wire or headphones are connected to the 9th pin of Arduino which is PWM pin of the Arduino. However, the output should be amplified using external audio amplifier. This study can also read the audio books and plays via speaker/headphones. In this study the SD – Card is interfaced with the Arduino Uno controller. The SD-Card reader can be expanded up to 120 GB. In this prototype we have used 8 GB memory card, that is loaded with audio books, readable pdf and word documents. Arduino Uno reads the all the text files in the SD card reader and displays in the serial monitor and converts the text in to speech using PWM technique and plays the audio file via head phone and speakers. The voice output is not clearly audible hence an external audio amplifier is required to amplify and filter out the noises. In future the project can be extended by adding suitable braille keys, so that the voice synchronous with the braille texts.

**Future Scope**

The project can be extended in future by converting text to Braille keys. The rotatable Braille keys from A to Z or raised Braille dots (keys) can be used to design a Braille keypad. The fully refreshable Braille keypad can be developed in future for easy text to Braille converter.

**Ethical Clearance:** The Study is based on the Digital Processing of the sensor and its connectivity via IoT (Internet of Things). The Study is been conducted by the guidance of Head of the Department, Ms.R.J.Hemalatha.

This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

**Source of Funding:** It is one of the Self-funding projects of Department of Biomedical Engineering.

**Conflict of Interest:** Nil
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Intelligent Walking Stick for Deaf Blind People

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ABSTRACT

Among all the disabilities, blindness and deafness are the most common disabilities across the world. According to latest statistics of World Health Organization, 285 million people are visually impaired whereas 360 million people have disabling hearing loss [1]. Blind and deaf people face many problems in their daily life. And walking safely and confidently without human assistance in unfamiliar environment is very difficult for them. In this paper we propose an advanced blind stick that allows deaf blind people to navigate with ease using advanced technology. The designed blind stick not only detects obstacles like objects, water but also produce vibratory mechanism to aware person holding the stick. In this proposed project, ultrasonic sensors are integrated in stick which detects obstacles ahead using ultrasonic waves. The blind and deaf people can see the obstacles by using the smart walking cane with vibrating mechanism.

Keywords: Deaf and Blind people, obstacles, Ultrasonic-sensor, vibrators

Introduction

Any individual with low or no sight is very difficult to survive in today’s environment. People with both visual and hearing disability have to face many challenges in their daily life. The problem gets worse when they travel to an unfamiliar location. There are some navigation systems that assist blind people for their navigation with audio output. But these type of navigation system will not suit for Deaf and blind people. Our research focuses on obstacle detection in order to reduce navigation difficulties for visually impaired people [2]. Safety and confidence could be increased using devices that give a signal to find the direction of an obstacle-free path in unfamiliar or changing environments [3]. The walking cane is a simple and purely mechanical device dedicated to detect static obstacles on the ground.

In this project, a navigation device for the visually impaired has been proposed which is focused on providing vibration output for obstacle prevention and navigation using water detector, fire detector, moister detector, direction detector using wrist band and manhole detector. The aim of the project is to provide a low cost and efficient navigation aid for Deaf-blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic objects around them. The Deaf-blind traveler is dependent on other guides like white cane, information given by the people, trained dogs etc. in this an approach has been made to explain the novel design of that stick that will serve as a magic to blind and deaf for enjoying their life despite cursing the life [4].

Literature Survey

Smart walking cane is a device that assists the blind to navigate independently in unknown environment. Several devices have been designed to assist deaf and blind people. Arun G.et al [3] proposed a design for an intelligent stick that aids blind as well as deaf people for any kind of obstacle detection including water, potholes, AC mains. It has an added functionality of GPS and GSM module that will enable immediate provision of help to the person in case of an emergency. Likewise, Kher Chaitrali et al. [4] implemented a navigation device for the visually impaired which is focused on providing voice output for obstacle prevention and navigation.
using infrared sensors, RFID technology, and android devices. The proposed device is used for guiding individuals who are partially sighted or blind. Nadia Nowshin et al [5] proposed technologies behind blind sticks are upgrading day by day. And our model ensures one thing that is making the task of moving of a blind person easy and comfortable. The stick is also very light and handy to carry. And the components or parts that we used in the stick are also easily available and less in cost. A.Sangami, et al [6] proposed a concept of smart stick for blind person with navigation system with GPS to identify the Blind person and with emergency button in emergency contact G.Prasanthi et al [7] proposed a system with advancement in obstacle in up, down and front direction. The disadvantage of this solutions are there are many smart walking cane for only blind in audio output format but it is difficult for the deaf blind subject. And in all the proposed system the nature of obstacle is not provided to the subject which is important for them. Artificial vision can also assist blind people [9]. Likewise the range covered by the sensor is very less so the existence of obstacles will not be intimated to the subject. Furthermore, in the case, where information is transmitted as an acute sound, that may happens several times especially when the obstacle is very close.

**Methodology**

The smart walking cane consist of two systems detection system and Wrist band as shown in Fig.1.Various sensors are placed in cane for better detection of obstacles.

**Fig. 1: Block Diagram of Smart cane**

**Smart cane with Detection system:** The stick will be designed and fabricated with suitable light weight material. The cane is in red white color to denote the subject is blind and deaf. The detection system consists of Ultrasound sensor, Fire sensor and Water sensor. There are about four ultrasound sensor is placed on the developed stick which detects the obstacle. The ultrasound sensor works on the principle that it produces a short and high frequency signal if there is objects, echo signals will be reflected back. This HC-SR04 ultrasound sensor is used to detect obstacle around 270 degree.

Fire sensor and water sensor will be placed at the bottom of stick which detects fire and water and give signal to the microcontroller. All six sensors detect obstacle and send the signal to an Arduino module. The Arduino gives signal to the vibrator if the sensor detects obstacles through Bluetooth module.

**Receiver Band:** The Receiver band is fabricated with light weight material and user-friendly. Four vibrator sensors are attached to the band in four directions. The vibrators are attached to the welgrow tape for easy placement. The Vibration sensor has been used to produce Vibratory output that will aid the deaf person about the presence of potential obstacles. The detection system placed on developed stick with Radio frequency transmitter will be interfaced with the Receiver band through RF receiver. The vibrator receiver band can be placed in any part of the subject for their easy convenience.

**Result and Discussion**

The developed smart cane with receiver band is tested in Real time. The subject is artificially made blind and deaf and asked to notify the object direction by using the smart cane.

This paper proposes design for smart walking cane that supports the people with blind as well as deaf people which detects any kind of obstacles including water, fire. Since ultrasound sensor detects 270 degree obstacles from any direction can be detected by the subject. The objective is to provide an aid to visually impaired and deaf people which will assist them everywhere they go. This system is more reliable and efficient than other proposed system.

**Future Scope**

The project can be further enhanced by adding functionality of GPS and GSM module that will enable
immediate provision of help to the person in case of an emergency \cite{8-10}. This makes the system further more compact.

**Ethical Clearance:** The Study is based on the design and development of aiding device. The Study is been conducted by the guidance of Head of the Department, Ms.R.J.Hemalatha. This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

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**Conflict of Interest:** Nil

**REFERENCES**


3D Printed Eco Friendly Smart Prosthetic Arm with Rotating Wrist

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ABSTRACT

This paper proposes a novel method of development of low cost robotic prosthetic arm with five fingers and rotating wrist using a 3D printing technology. Amputation generally refers to removal of parts of limb due to trauma or surgery. Most of the EEG and EMG prosthetic hands have several shortcomings such as low intensity, high price, et al. This has blocked the amputee people from practical realization. To overcome these problems, we are using leap motion sensors which can replicate the function of original hand. Servo motors are used to achieve flexibility of up to 90 degrees and an Arduino is also used to program the device. Finger motions are controlled by servomotors which work as actuators while the rotation of each servomotor was controlled using microcontroller. This device can help a partially amputee person to lead a normal life in society and gain his self-esteem.

Keywords: Actuators, flex sensors, servo motors, Arduino

Introduction

As we know that there are many different designs of prosthetic limbs present in market. Though these artificial limbs are user friendly and looks very much similar to the original one they are not cost effective. The existing methods use Electromyography (EMG) and Electroencephalography (EEG) signals as input for stimulation of the prosthetic limb. Acquiring these signals are not just painful but costly too. Amputation is a very serious problem which not just affects a person physically but also affects mentally. Due to the availability of costly prosthetic limbs the amputees do not tend to take an initiative for rehabilitation of the amputated part. The main aim of this project is to design a cost effective artificial limb that is eco-friendly as well as user friendly.

Literature Survey

In the current scenario the prosthetic arm is controlled using Raspberry pi microcontroller. It also uses wireless network for communication. Even though it is affordable the smooth movement of the limb couldn’t be obtained [1]. Similarly different servo motors were used in several researches to obtain decreased thermal load and faster acceleration [3]. One of the most important challenges is development of artificial limb through gesture recognition. Several sensors are used to observe the three dimensional (3D) perception of human hand movement [5]. The usage of leap motion sensor is advantageous as it provides a better communication between human and computer interface [7]. This simple device enables us to control and command our robots with gestures [5,7]. Since the main idea is to use a 3D printing technology for building a prosthetic arm which is also a step towards the development of low-cost prosthesis as a possible aid for low income people with disabilities. The mechanical strength of different 3D printed filaments is studied and examined. The greatest disadvantage is that the available filaments like PLA and ABS can melt very easily [15]. The layer height and print orientation also plays a major role in determining the strength [15]. In some cases, acrylic pieces are also

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used as it is weight reliable and cost effective\(^{[17]}\). Several researches were carried out using EMG signals but the result was limited to functioning of limited number of joints only and also led to problems such as motion artefacts \(^{[16]}\). 3D printing technology to build a cost-effective limb which can withstand higher thermal load. Temperature sensors are attached to it to continuously monitor the temperature of the circuit and the filament. The main aim of the project is to design a cost-effective prosthetic limb for amputees.

**Methodology**

The initial step involved is material collection. In this project microcontroller acts as a heart of the prosthetic arm. Servo motors will work as actuators for finger and wrist movement. The controlling of the prosthetic arm will be performed by Gesture control with the help of leap motion sensor. Temperature sensor is used to overcome the heating and burning problem for servo motor. 3D printing with Eco-friendly and strong filament PLA plus (Poly lactic acid) which is made of bio plastic is used. The artificial hand was made such that it appears similar to that of original hand. The prosthetic arm was integrated with servo motors. The power supply was provided to the Arduino and it was tested. The Arduino was programmed and tested with respect to leap motion sensor. Finally, the comparison was done with respect to original hand movements.

**Hardware Required**

**3D Printed Artificial Hand:** The artificial hand was designed using a 3D printer. The filament used for printing is PLA Plus (Poly Lactic acid). Around two kilograms of PLA plus filament was used to design the artificial hand. Human hand’s characters such as power, grasping ability, physical appearance was studied and compiled with that of artificial hand. The ultimate goal of the project was to design a cost effective and a user-friendly hand. The fingers of the hand can be individually activated using servo motors.

**Arduino Mega 2560:** The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins with 16 analog inputs, 16 MHz crystal oscillator, a USB connection. The Mega 2560 board is compatible with most servo shields which is very useful to give power supply to multiple servo motor with single connection. The operating Voltage is 5V and input Voltage is around 7-12V. The storage space is around 256 KB (available as flash memory) of which 8 KB is used by boot loader. The clock speed provided is around 16 MHz.

**Servo Motor:** A simple motor used for specific angular motions. The servo motor chosen here is of light weight. It weighs around 55g. The voltage provided is around 4.8V or 6V. The operating speed range of the servo motor is around 0.20sec/60 degree up to 0.16sec/60 degrees. The torque is around 9.4kg.cm (4.8v) - 11kg. cm. The gear material is made of metal and the gear type is digital motor that is brushless.

**Leap Motion Sensor:** In this project the Leap Motion Sensor has been selected it has comparatively greater accuracy than other commercial sensors. The controls such as movement of hand and forearm are performed using a leap motion sensor. The leap motion sensor can capture around 200 frames per second through its infrared cameras. The sensor gives an accuracy of up to 0.2mm in general. The leap motion sensor mainly consists of two monochrome cameras together with three infrared LEDs. These LEDs present in the sensor generate a 3D dot pattern. These patterns help to capture numerous numbers of frames within a short period of time. The main aim of using leap motion sensor is that it detects the movement of hand and wrist in three dimensional positions. The view field of the sensor is 150 degrees with 0.25m\(^3\) interactive 3D space. It appears like an inverted pyramid shape centered on the device.

**Temperature Sensor:** The MF58 is a NTC thermistor manufactured using a combination of ceramic and semiconductor techniques. This type of sensor is usable in high temperature and high moisture environments. It is equipped with tinned axial leads and then wrapped with purified glass. The advantage of using this type of sensor is that it is highly sensitive and gives rapid response. The operating temperature range is -55 degree Celsius to approximately 200 degree Celsius. The most important features include high stability, repeatability and high tolerance. The resistance of the sensor at 25 degree Celsius is around 10k to 100k. The maximum power used is 50mW. The temperature sensor is added to the circuit in order to monitor the increase in temperature. Since we are using Leap Motion Sensor the temperature of the circuit may increase drastically. Moreover, the PLA plus filament might start to melt if the temperature increases drastically.
Software Required: The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS and Linux. The environment is written in Java and based on Processing.

Result and Discussion

In the current scenario the amputee has to remove the corresponding body part due to accidental issues or diabetes. In this project we have come up with a solution for such low income amputees. The prosthetic limb has been designed such that the amputee will be able to perform several task using the prosthetic limb. The limb has been tested several times with several degrees of freedom and the results obtained are quite satisfactory. Because of removal of limb by the amputees they tend to lose their self-confidence. This project has come up with a proposal which will not only increase their self-confidence but will also make them feel comfortable with the designed prosthetic limb. The prosthetic limb was able to mimic almost all the movements of the original working hand. Since we had used leap motion sensor the sensors and the cameras were able to capture the exact motions of the original hand. The movements as well as the grasping ability were better than the previously proposed work [9]. Several researches were done using brain computer interface but the results obtained were not satisfactory. Similarly in few cases signals were acquired from forearm but it did not give accurate results. The grasping ability of individual fingers couldn’t be identified accurately [12]. In this project gestures are completely used for movement of prosthetic limb [7]. A completely wearable mind controlled prosthetic arm was also designed but it had several limitations [9].

Future Scope

The project can be extended in future by using miniaturized components which will make it light weight and easily wearable.

Ethical Clearance: The Study is been conducted by the guidance of Head of the Department, Ms.R.J.Hemalatha.

This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

Source of Funding: It is one of the Self-funding projects of Department of Biomedical Engineering.

Conflict of Interest: Nil

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Glaucma Detection in Ultrasound Biomicroscopy Images by Parametric Analysis

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ABSTRACT

Biomedical image processing has experienced a dramatic expansion in research field. The processing and classification of medical images has gradually improved the resolution leading to detailed gray scale images. Along with the development of new technologies and usage of various imaging modalities the number of challenges has also increased. The present proposal proposes a novel method for detection of abnormalities in the anterior chamber of eye during the early stages of glaucoma. The increased pressure in the intraocular region can damage the optic nerve leading to a defect called glaucoma. One of the major complication related to glaucoma is, if glaucoma is not treated on time it can cause total permanent blindness within a few years. Ultrasound Biomicroscopy is a technique that works on the principle of ultrasonography to detect the abnormalities present in deep inner layers of the cornea. The principal objective of this project is to reduce speckle noise and categorize the statistical and morphological features. Several noise reduction filters are used for the pre-processed of UBM images. The proposed proposal aims to provide cross sectional images of anterior chamber of the eye with high resolution. The linear SVM filter being the most effective one is used to differentiate and classify the normal and glaucomatous image.

Keywords: Ultrasound Bio-Microscopy, Glaucoma, Linear SVM

Introduction

The use of computers in facilitating the processing and analysis of medical images has become necessary due to the increase in number of diseases. Glaucoma is one such chronic eye disorder that damages the optic nerve and gradually leads to permanent blindness. It is termed as silent thief of eye as its symptoms occur only when it is quite advanced and hence it is critical to detect it on-time. The aqueous fluid continuously produced by the eye must be drained to maintain normal pressure in the eye. When the aqueous fluid’s drainage path gets blocked due to trauma or infections, the fluid gets accumulated that leads to increase in pressure. This process results in damage of optic nerve which gradually causes glaucoma. Ultrasound Biomicroscopy is a technique that uses high frequency ultrasound to produce high resolution detailed gray scale images. It was developed in late 1980s by Pavlin, Sherar, Foster in Toronto. UBM allows to acquire in vivo images of the deep ocular segments in a non-invasive way. The structural details can be captured at near microscopic resolution and it can be evaluated both qualitatively and quantitatively. Any deformity in the anterior chamber can be identified by analyzing the UBM image.

Literature Survey

A novel method has been proposed for standardized imaging and measurement of anterior segment of eye. The reliability analysis is done using UBM and ImageJ software where 45 structural parameters were measured in UBM images of patients with cataract, glaucoma and dysgenesis and a good IOR and IOA were yielded, based on preplaced landmarks, in the quantitative assessment of anterior segment structures⁴¹. Several algorithms have also been proposed to detect glaucoma in retinal fundus image and classification has been done based on the severity of certain methods such as green channel extraction, filtering etc. The features were extracted and were classified using ANFIS and SVM. Certain parameters such as specificity, accuracy and sensitivity were evaluated and compared to diagnose the glaucoma disorder ². Several researchers have made a prospective observational study on the features of upper eyelid in
healthy and different types of congenital ptosis cases using 50MHz probe. Lid-thickness, tarsal-thickness, orbicularis oculi and Levator-Muller-orbital Septum-conjunctival Complex (LMSC) were measured in primary gaze, compared between four groups and the results were analyzed statistically using ANOVA test. This study showed that various eyelid structures can be identified with good anatomical correspondence and structural alterations of eyelids can be studied in normal and different types of congenital ptosis conditions respectively with the help of UBM [3]. It is also studied that ultrasound pachymetry (UP) and ultrasound biomicroscopy (UBM) produce similar central corneal thickness (CCT) measurements in human patients [4]. An algorithm was designed for premature detection of primary open angle glaucoma in retinal fundus images where preprocessing methods such as histogram equalization and 2-D median filter enhanced the image quality and removed the noise from the images [5]. The preprocessing techniques such as illumination correction, segmentation of blood vessel and inpainting were applied to the images and features were extracted from the optic disc and optic cup. Later depending upon the technique various classifiers such as SVM, back propagation neural network, and ANFIS, were used to differentiate between normal and abnormal cases of glaucoma [6]. UBM and AS-OCT both technologies were able to produce real time high resolution cross-sectional images upon which biometric descriptors can be used for quantitative characterization, diagnosis, as well as surgical management of glaucoma [7]. The parameters such as anterior chamber depth (ACD), lenticular thickness (LT), angle opening distance (AOD), iris–lens contact distance(ILCD), and trabecular-ciliary process distance(TCPD), Absolute lenticular position (ALP), Axial length (AL), and relative lenticular position (RLP) were measured and concluded that phacomorphic glaucoma (PG) eyes have an anatomical predisposition to develop primary narrow angle glaucoma [8]. A semi-automated algorithm was proposed for the screening of glaucoma by measuring spatial parameters such as Anterior Chamber Area (ACA), Trabecular Iris Space Area (TISA), Angle of Departure (AOD) etc which lead to the conclusion that these parameters provided a reasonable range limit for diagnosing closed angle glaucoma [9]. Several research works were also carried out depending on the simulation results obtained from an eye segmentation process [10].

**Methodology**

The initial step involved the collection of UBM images. The input UBM image is enhanced by reducing speckle noise using despeckling filters such as Linear filter, Median filter, Anisotropic diffusion filter, Speckle anisotropic diffusion filter(srad). It was found that linear filter efficiently reduces speckle noise in UBM images compared to other despeckling filters by measuring their efficiency through statistical and image quality metrics analysis. The images had to be pre processed to select an appropriate region of interest. In glaucoma, as the fluid gets accumulated on the outer edge of the iris, the structure of the iris gradually changes. Thus the iris region is taken as the region of interest. Statistical parameters such as Mean, Median, S.D., Skewness, Kurtosis and Morphological parameters such as Iris Area, Iris Perimeter, Angle, Angle of Departure(AOD), Angle recess area(ARA) were computed. The statistical analysis and some of the morphological analysis namely iris area, iris perimeter and angle were performed using ImageJ software whereas the angle morphological parameters namely AOD and ARA were evaluated using MATLAB.

![Flow Diagram for Detection & Classification of Glaucoma](image1.png)

**Fig. 1: Flow Diagram for Detection & Classification of Glaucoma**

The morphological analysis included quantitative parameters such as Iris Area, Iris Lens Contact Distance (ILCD), Iris Lens Angle (ILA), Iris Volume, Iris concavity/convexity and Chamber Volume.

**Iris Area:** The Iris area was calculated by marking the iris region manually through freehand sketching using ImageJ software. The total area of the Iris was calculated and the histogram was also analyzed [11].
**Iris Perimeter:** In ImageJ software, through freehand sketching, the iris region is marked manually and the boundary of the iris is evaluated for which the histogram is also analyzed.

**Angle:** The human eye continuously produces a fluid called aqueous humor. The drainage of this fluid is important as the accumulation may lead to glaucoma or blindness. So the Angle refers to the drainage angle inside the eye that controls the outflow of the aqueous humor. It is the intersection point of cornea and iris where the blockage occurs \([12]\). It is measured by marking it manually from the apex point to the cornea and iris.

**Angle of Departure (AOD):** The perpendicular distance between the iris and the perpendicular distance between the trabecular meshwork is referred to as angle of departure. This point lies 0.5mm (500µm) anterior to the scleral spur. The only anatomical landmark which is used as a reference point to measure AOD is the scleral spur \([13]\). Thus the input parameters considered for measuring AOD are Scleral Spur and apex point.

**Trabecular Iris Space Area (TISA):** The area between the Angle opening distance 0.5mm and the perpendicular line drawn from scleral spur till it reaches iris (at 0.5mm) is known as the Trabecular Iris Space Area \([14]\). It is calculated using the area of trapezium formula as given below in equation (1).

\[
\text{Area of Trapezium} = \frac{h(a+b)}{2} \quad \ldots(1)
\]

Where, 
- \(a\) – length of one parallel slide; 
- \(b\) – length of the other parallel slide; 
- \(h\) – height of the trapezium

**Angle Recess Area (ARA):** Angle Recess Area refers to the total area lying in between the AOD 500µm and the apex point. Mathematically it is calculated as the summation of TISA and the triangular area between the apex point and the perpendicular line from scleral spur\([15]\). So, to get ARA, first TISA is calculated using the trapezium formula as discussed above and then the triangular area in the apex region is computed using the area of triangle formula as given below in equation (2).

\[
\text{Area of Triangle} = \sqrt{s(s-a)(s-b)(s-c)} \quad \ldots(2)
\]

Where, \(a, b, c\) are length of sides of triangle; 
\[s = \frac{(a+b+c)}{2}\]

Thus, the statistical and morphological parameters analyzed for the UBM images are then subjected to classification for classifying the normal and abnormal images using Linear SVM (Support Vector Machine) classifier. Then the actual and predicted values of classification are obtained for analysing the performance of the classifier.

**Result and Discussion**

The UBM images of the eye are generally grayscale images. In the proposed work 10 normal and 10 abnormal images were taken. These images were despeckled using Linear filter, Median filter, Anisotropic diffusion filter, Speckle anisotropic diffusion filter(srad) and it was concluded that linear filter works efficiently on UBM images. The efficiency of these filters were measured through the analysis and comparison of certain filters and image quality parameters. The iris region was selected as the region of interest and then the statistical parameters such as Mean, Median, S.D., Skewness, Kurtosis and Morphological parameters such as Iris Area, Iris Perimeter, Angle, Angle of Departure(AOD), Angle recess area(ARA) were computed for both normal and abnormal UBM images and tabulated as shown below in table 1&2 respectively.

**Table 1: Statistical and Morphological Parameters of Normal UBM Images**

<table>
<thead>
<tr>
<th>Images</th>
<th>Mean</th>
<th>Median</th>
<th>S.D.</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Iris Area (in mm²)</th>
<th>Iris Perimeter (in mm)</th>
<th>Angle (in deg)</th>
<th>AOD _500 (mm)</th>
<th>ARA _500 (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image1</td>
<td>117.9</td>
<td>117</td>
<td>62.27</td>
<td>0.246</td>
<td>-0.42</td>
<td>5.55</td>
<td>418.46</td>
<td>30.49</td>
<td>0.874</td>
<td>0.211</td>
</tr>
<tr>
<td>Image2</td>
<td>133.7</td>
<td>181</td>
<td>58.92</td>
<td>-0.795</td>
<td>0.727</td>
<td>6.89</td>
<td>422.92</td>
<td>39.48</td>
<td>0.723</td>
<td>0.142</td>
</tr>
<tr>
<td>Image3</td>
<td>87.33</td>
<td>86</td>
<td>25.59</td>
<td>0.31</td>
<td>0.346</td>
<td>5.19</td>
<td>434.51</td>
<td>25.59</td>
<td>0.253</td>
<td>0.064</td>
</tr>
<tr>
<td>Image4</td>
<td>77.46</td>
<td>75</td>
<td>29.53</td>
<td>0.278</td>
<td>-0.316</td>
<td>6.11</td>
<td>440.83</td>
<td>46.79</td>
<td>0.506</td>
<td>0.128</td>
</tr>
<tr>
<td>Image5</td>
<td>83.08</td>
<td>78</td>
<td>32.72</td>
<td>0.428</td>
<td>0.164</td>
<td>6.44</td>
<td>456.70</td>
<td>50.27</td>
<td>0.898</td>
<td>0.189</td>
</tr>
<tr>
<td>Image6</td>
<td>92.73</td>
<td>89</td>
<td>63.99</td>
<td>0.469</td>
<td>0.732</td>
<td>5.29</td>
<td>466.79</td>
<td>41.93</td>
<td>0.463</td>
<td>0.113</td>
</tr>
<tr>
<td>Image7</td>
<td>81.02</td>
<td>94</td>
<td>69.55</td>
<td>0.649</td>
<td>0.636</td>
<td>6.32</td>
<td>415.43</td>
<td>37.26</td>
<td>0.805</td>
<td>0.302</td>
</tr>
<tr>
<td>Image8</td>
<td>78.98</td>
<td>86</td>
<td>57.07</td>
<td>0.312</td>
<td>-0.62</td>
<td>6.13</td>
<td>389.26</td>
<td>29.13</td>
<td>0.477</td>
<td>0.152</td>
</tr>
<tr>
<td>Image9</td>
<td>84.55</td>
<td>112</td>
<td>61.47</td>
<td>0.441</td>
<td>0.727</td>
<td>5.69</td>
<td>424.67</td>
<td>38.21</td>
<td>0.399</td>
<td>0.078</td>
</tr>
<tr>
<td>Image10</td>
<td>82.61</td>
<td>89</td>
<td>38.28</td>
<td>0.611</td>
<td>0.676</td>
<td>5.48</td>
<td>411.08</td>
<td>26.04</td>
<td>0.662</td>
<td>0.160</td>
</tr>
</tbody>
</table>
In this work, the UBM images were preprocessed by despeckling with linear filter and iris region was selected as region of interest for which statistical and morphological parameters were analyzed. AOD and ARA are considered the key important morphological parameters as they are one among the angle parameters, established by Pavlin, which are to be evaluated so that the blockage of drainage channel can be diagnosed. The values of these parameters were classified using the linear SVM classifier for classifying the normal and abnormal UBM images and the actual and predicted values were measured, thereby analysing the performance of the classifier as shown below in the figure 2.

The overall accuracy, specificity and sensitivity were 95%, 100% and 90.9% respectively when run on a dataset of 20 images. From this, it is found that the linear SVM classifier gives good success percentage in classifying the normal and abnormal UBM images.

**Future Scope**

In future, this work can be extended for detection of presence of glaucoma and classification of normal and abnormal images for above 20 UBM images which would provide efficient results for accurate diagnosis of glaucoma. In certain cases, the blockage of aqueous fluid occurs in the area of lens contact with the iris resulting in glaucoma. The parameters considered in this work gives no indication about this obstruction and so two parameters namely Iris Lens Angle (ILA) and Iris Lens Contact Distance can be considered in future as they give information about the blockage of aqueous fluid near the lens area.

**Ethical Clearance:** The Study is based on the Digital Processing of the sensor and its connectivity via IoT (Internet of Things). The Study is been conducted by the guidance of Head of the Department, Ms.R.J.Hemalatha.

This Study does not require Ethical Clearance. This Study is conducted in the Biomedical Instrumentation Lab of Vels Institute of Science Technology and Advanced Studies – Department of Biomedical Engineering, Chennai -117.

**Source of Funding:** It is one of the Self-funding projects of Department of Biomedical Engineering.

**Conflict of Interest:** Nil

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Design of Equalizer for ADSL Modem

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Abstract

Performance of any communication system depends on the characteristic of the channel and the presence of noise. Channel distortion is deterministic in nature, but noise behavior is random and cannot be predicted in advance (beforehand). To reconstruct the signal on the receiver side, use of equalizer can be one of the solution to compensate distortion by the channel and minimize the effect of noise. This paper has proposed fractionally spaced equalizer for custom architecture of ADSL modem. The obtained result in the paper shows that there is an improvement in the performance of ADSL modem with the use of fractionally spaced equalizer because it is immune to the phase change. The obtained results are compared with symbol-spaced equalizer for different lengths and gauge of the wire. MATLAB 2015 is used for the simulation of code and implementation of ADSL modem is done on FPGA, to calculate the amount of power consumption.

Keywords: modem, adsl, blocks, speed

Introduction

DSL is one of the very old broadband communication technology used to provide high-speed data communication on the telephone line. Twisted pair wires are used as a communication medium for transmission of data. The characteristic of wireline channel is inversely proportionate to frequency and lengths of wire. The different DSL techniques: ADSL, ADSL2, HDSL, VDSL, VDSL2, among them ADSL[10] is most commonly used, since the telephone cables are already laid and it covers many parts of the world. VDSL provides high data rate but it can be used for shorter distance[11]. According to ITU-T recommendation, the modulation technique in ADSL can be single carrier modulation or discrete multi-tone modulation (DMT)[7,8]. Single carrier modulation refers to all those techniques which use only one carrier, some of the techniques are Quadrature amplitude modulation (QAM), carrierless amplitude phase modulation (CAP) etc. One of the multicarrier modulation technique recommended for ADSL is DMT modulation. Which use FFT and DFT algorithms to minimize the computational complexity of DMT system.

The algorithms used for the design of equalizer are LMS, RLS, and ZF, along with symbol-spaced and fractionally spaced equalizer structure [1,2]. The above-mentioned algorithms can be designed in the time domain and in the frequency domain based on the application.

In this paper, the simulation of ADSL transceiver system is done on MATLAB 2015, the design of DMT modem is carried out in Verilog HDL and prototyping is done in Kintex 7 FPGA which is the latest version of FPGA with more features [5,6]. The input given to the modem is data stream and the verification of result are based on the similarity between the output and the input data stream. The prototyping of the individual blocks is done on Spartan3, an FPGA device.

The paper is organized as follows. The System configuration of ADSL modem has been explained in Section II. Simulation and results for BER is given in section III. Conclusion and Reference are summarized in section IV.

System configuration

According to the ITU-T G.992.1, Discrete Multi-Tone (DMT) modulation is used for ADSL system. The
complete DMT transceiver is divided in three parts, modulator, demodulator and channel. The DMT modem uses Fourier Transform as its basis function to divide the channel into sub-channels. IDFT blocks are used at the sender side, DFT blocks at the receiver side along with equalizer.

![Diagram of DMT Modem](image)

The performance of ADSL system is measured using fractionally spaced and symbol spaced TEQ.

**Fractionally spaced equalizer:** The block diagram of fractionally spaced equalizer is shown in Fig 2, in the diagram the sampling rate is double to the symbol rate. The fractionally spaced equalizer is designed using LMS algorithm. The sampling rate of the fractionally spaced equalizer is higher than the symbol rate, which increases the complexity and required the power of the system.

![Diagram of Fractionally Spaced Equalizer](image)

**Simulation and result:** The parameter used for the simulation of code is given in Table 1.

**Table 1** Simulation Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of bits (randomly bits)</td>
<td>1000</td>
</tr>
<tr>
<td>Modulation technique</td>
<td>4, 6, 8 bit QAM (DMT)</td>
</tr>
<tr>
<td>Channel spacing</td>
<td>4.3125 KHz</td>
</tr>
<tr>
<td>Sample frequency</td>
<td>8192 Hz</td>
</tr>
</tbody>
</table>

Parameters given in Table 1 are used for simulation of transceiver system. 24-gauge wire of 4kfeet length is used for the modeling of wireline channel. The performance of ADSL transceiver in terms of SER is given in Table 2. The result shows the variation in SER with length of wire, number of iteration.

**Table 2** SER using TDE (LMS) for 24Gauge 8QAM

<table>
<thead>
<tr>
<th>Iteration/ Length of wire in feet</th>
<th>1024</th>
<th>2048</th>
<th>4096</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.4511</td>
<td>0.4322</td>
<td>0.4271</td>
</tr>
<tr>
<td>6</td>
<td>0.4531</td>
<td>0.4336</td>
<td>0.4299</td>
</tr>
<tr>
<td>9</td>
<td>0.4653</td>
<td>0.4432</td>
<td>0.4377</td>
</tr>
<tr>
<td>12</td>
<td>0.4721</td>
<td>0.4498</td>
<td>0.4398</td>
</tr>
<tr>
<td>15</td>
<td>0.4922</td>
<td>0.4597</td>
<td>0.4417</td>
</tr>
<tr>
<td>18</td>
<td>0.5547</td>
<td>0.4675</td>
<td>0.4502</td>
</tr>
</tbody>
</table>

The performance of ADSL transceiver using symbol-spaced TDE is shown in Table 3. The result is verified for different length of wire. From the graph it is clear that the performance of system degrades with increase in the length of channel. Comparison between Symbol-spaced and Fractionally-spaced Time domain equalizer for 24-gauge ADSL channel of 6 kFeet lengths of twisted pair wire is given in Table 3. LMS algorithm is used for the design of symbol and fractionally spaced equalizer.

**Table 3** Comparison between Symbol-spaced and Fractionally-spaced TDE

<table>
<thead>
<tr>
<th>SNR 15 dB, step size = 0.75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iteration/ Length of wire in feet</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>18</td>
</tr>
</tbody>
</table>
Table 3 Comparison of SER for Symbol-spaced and fractionally spaced TDE

(24 Gauge wire of 6 Kfeet, up-sampled by 2 and step size =0.75, LMS)

<table>
<thead>
<tr>
<th>SNR (dB)</th>
<th>4QAM</th>
<th>6QAM</th>
<th>8QAM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fractionally</td>
<td>Symbol</td>
<td>Fractionally</td>
</tr>
<tr>
<td>5</td>
<td>.1328</td>
<td>.2253</td>
<td>.4492</td>
</tr>
<tr>
<td>10</td>
<td>.0195</td>
<td>.0612</td>
<td>.2188</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>.0013</td>
<td>.0313</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

From the Fig 3, the performance of the fractionally spaced equalizer is better for all level of QAM modulation.

Symbol-spaced and fractionally spaced equalization algorithms are used to detect the transmitted symbol on the receiver side. Performance of DMT transceiver is compared using a different combination of Time domain and Frequency domain equalizers for ADSL systems.

A brief comparison between TDE (LMS) algorithm and FDE (ZF) algorithm with respect to symbol error rate (SER) and signal to noise ratio (SNR) on ADSL channel is given in Table 4. Result of the DMT transceiver is verified for different length and gauge of wire with variation in the value of step size. The performance of TDE (LMS) is better compare to FDE (ZF).

Table 4 Comparison between (fractionally spaced) TEQ and FEQ for (ADSL) transceiver

<table>
<thead>
<tr>
<th>SNR (24Gauge)</th>
<th>4QAM</th>
<th>6QAM</th>
<th>8QAM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FDE (ZF)</td>
<td>TDE (LMS)</td>
<td>FDE (ZF)</td>
</tr>
<tr>
<td>5</td>
<td>0.675781250</td>
<td>0.1328</td>
<td>0.92968750</td>
</tr>
<tr>
<td>10</td>
<td>0.429687500</td>
<td>0.0195</td>
<td>0.80078125</td>
</tr>
<tr>
<td>15</td>
<td>0.125000000</td>
<td>0</td>
<td>0.52734375</td>
</tr>
<tr>
<td>20</td>
<td>0.003906250</td>
<td>0</td>
<td>0.1718750</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0.01171875</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
DMT Modem Implementation

Fig 4 shows the implementation of a DMT modulator at the transmitting side. As mentioned earlier it consists of constellation encoder, constellation size register, gain register, IDFT block, gain blocks, add cyclic prefix and asynchronous FIFO. Similarly, demodulator at the receiver side shown in Fig 5, has encoder replaced by the decoder, IDFT by DFT and add cyclic prefix by remove cyclic prefix.

Fig 4. DMT modulator at the Transmitter side

Fig 5. DMT Demodulator on the Receiver side

The complete design of DMT modem requires a lot of memory and hence high-end boards like Kintex 7 are needed. Due to the unavailability of high-endboards, each individual blocks are implemented on Spartan3 FPGA. Spartan 3 FPGA has less memory and input-output pins and hence due to these constraints the number of input-outputs of each block are scaled down and implemented. Fig 6 shows the experimental setup for testing the subsystems on the Spartan3 device. The next chapter discusses the simulation results of each block and explains them briefly.

Fig 6. External setup for testing on Spartan3

The individual block of DMT transceiver is designed and the requirement of power for the individual block is given Table 5.

Table 5 Requirement of power for individual block of DMT transceiver system

<table>
<thead>
<tr>
<th>Individual block of DMT transceiver</th>
<th>Power required (mw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit extraction</td>
<td>14</td>
</tr>
<tr>
<td>Constellation encoder</td>
<td>23</td>
</tr>
<tr>
<td>Multiplication by a gain factor</td>
<td>14</td>
</tr>
<tr>
<td>IDFT</td>
<td>183</td>
</tr>
<tr>
<td>Add cyclic prefix</td>
<td>60</td>
</tr>
<tr>
<td>Asynchronous FIFO</td>
<td>15</td>
</tr>
<tr>
<td>Remove cyclic prefix</td>
<td>23</td>
</tr>
<tr>
<td>DFT</td>
<td>117</td>
</tr>
<tr>
<td>Division by gain factor</td>
<td>24</td>
</tr>
<tr>
<td>Constellation decoder</td>
<td>14</td>
</tr>
</tbody>
</table>

Simulation and Testing

The digital subsystems designed were simulated using simulation software and the subsystems are tested on hardware FPGA board for different input combinations. The digital subsystems are designed and simulated using ISE Design Suite v12.1 from Xilinx Incorporation. The codes were downloaded onto the Spartan3 FPGA kit to complete the prototyping.

Conclusion

The implementation of subsystems is done using Verilog Hardware Description Language which is most
commonly used in the design and verification of digital circuits at the register-transfer level of abstraction. The Verilog codes are developed using Xilinx ISE Design Suite v12.1 as the Integrated Development Environment.

The major scope of the work is to integrate all the subsystems of transceiver modem. This process involves a challenging job of port mapping and module calls in Verilog HDL.

**Ethical Clearance - Not required**

**Source of Funding - Self**

**Conflict of Interest - Nil**

**References**


[8] ITU-T standard G.test.bis


Creating Convolutional Neural Network and Training it to Classify Images using Machine Learning

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Abstract

Machine Learning, also the sub part of artificial intelligence is a process of making a computer learn from examples and experiences. It is be used in various fields such as data mining, personal assistance, social media services, spam email detection etc. One of the most used application of machine learning is Image processing, Image recognition and Image classification. For image recognition neural networks are used in machine learning, which are inspired by real neural networks of humans that we use to classify images. For creating neural networks the Keras library is used which is written in python and runs on top of the tensor flow library.

Keywords— Machine Learning, Convolutional Neural Networks, Pooling, Relu, keras

Introduction

Machine learning is defined as a process of making a computer learn from examples and experiences. Machine learning is the sub part of artificial intelligence which is based on the idea that computers can learn from data sets and categorize the inputs.

The process of making computer learn from experience and training is known as Machine Learning. In machine learning the data is fed to an algorithm on the basis of which a logic is build. Machine Learning allows software to become more accurate and powerful by themselves by learning from the previous outputs.

One of the most common algorithms of machine learning is the image classification algorithm which can be used to categorize images of objects into fixed categories.

Machine learning allows analysis of massive quantities of data. It is approximately related to computational statistics, which works on making predictions through the use of computers. Machine learning is a method used to formulate complex models and algorithms that lend themselves to prediction, known as predictive analysis.

Machine learning provides latest approach toward making our computational processes more efficient, cost-effective, and reliable. This kind of learning deals with the problem of how to construct such computer programs which improve their performance at same tasks through past experience.

ML algorithms have proved to be of a great practical use in a variety of applications. Especially in the field of software engineering it has turned out to be more productive, so that many software development and maintenance tasks can be completed in terms of learning algorithms.

There are different types of Machine Learning tasks:

Supervised Learning: in this type of training, the program is trained on an already defined set of training examples, which then makes it easier to reach accurate conclusion when given new data.

Unsupervised Learning: in this type of training, the program is given a bunch of data and must find patterns and relationships embedded in it

A. Examples of Machine Learning:

Most popular machine learning examples are: Face detection which is used to detect human faces in an image which can be used for security purposes, Email Categorisation which is used to classify images into spam or not spam categories, Diagnosis of Medical
Conditions which is used to detect medical conditions of patient, Weather predictions and many more.

One of the most popular products in development these days is Google’s self-driving car project which is entirely based on the concept of machine learning and artificial intelligence.

CONVOLUTIONAL NEURAL NETWORK

In this project we have taken the help of convolutional neural networks (CNN) which can be used to classify images based on the objects they are containing so, we have trained our Convolutional Neural Network in this project to classify images containing cats or dogs and other than these images are not identified. To achieve this problem we have taken the help of Keras which is an open source library written in python which operates on top of the tensor flow API prepared by google by which a neural network can be created to categorize the images.

When an image taken as an input, is given to a computer it is seen as an array containing pixels by the processor and is also saved as an array containing pixels. The size of every image is different from one another, so for simplicity we assume that the computer sees all the images as 32*32*3 resolution where 3 happens to be depth of the image (RGB values) and 32 is the height and the width of the image. These numbers are those only inputs of an image which a computer gets that a human may find meaningless.

![Image](image1.png)

**Figure 1 Image represented as a pixel of array**

The best and the most universal method to categorise images is by using Convolutional neural networks.

A. THE CONVOLUTIONAL LAYER

When a human see an image for example an image of a dog he/she looks for features just as legs, paws and mouth to classify them which are identifiable by most of the humans. Now for a computer to complete the work of classifying an image it is also essential to identify features such as the edges and curves in an image these features are called as low level features. By using a large number of these type of low level features the computer can build a feature map which may contain high level features just like humans look for this process of extracting high level features from an image by using low level features is well known as feature extraction.

![Image](image2.png)

**Figure 2 Basic Representation of neural network**

In any convolutional neural networks one may find many layers and the first layer of these networks is always the layer known as the convolutional layer. The image that is provided to the network as an input is also the input to this layer as a 32*32*3 value as per our example. In the convolutional layer a filter of size 5x5x3 is used which slides all over the image from the top left to bottom right in linear way. The region of the image/pixels on which the filter is convolving on is known the Receptive Field.

When the filter starts convolve/slide over the input image, it always starts from the top left position of the image and then it multiplies the values in the filter with the values of each pixels of the image which are summed up and thus gives 5*5*3 = 75 multiplications in total. Now this process is done over again and again for each location over the input array of pixels starting from top left to the bottom right. Now, the next step in which the filter is moved to the right by 1 unit and then the work of multiplication is repeated and then it moves to the right again by 1 unit and so on. After covering all the areas on the image we are left with a 28*28*1 array of numbers, which is known as the activation/feature map.

A 28 * 28 array is obtained as the activation map because the input picture contains 784 different areas where a 5*5 filter can fit over a 32*32 input picture. These 784 number of pixels obtained are stored to a 28*28 = 784 sized array.
B. Going Deeper Through the Network

Now, since in a convolutional neural network there are further layers too, which are in between the convolutional layers explained above. As we know that the convolutional layer is used to identify low level features just as edges and curves, in such an order just to predict the type of the image our network must also be able to make out higher level features such as legs, paws, hands, mouth etc. The output of the network after the very first convolutional layer is a 28 x 28 x 3 volume (where we assumed a 5 x 5 x 3 filter was used). Now as we move ahead in our network the output of the convolutional layer becomes the input of the second convolutional layer. Therefore in the first layer the input was the original image and for the second layer the input was the output of the first convolutional layer (activation map). Now when filters are applied on the output of the very first convolutional layer it gives us an output with even more level of features.

C. ReLU (Rectified Linear Unit)

ReLU is a nonlinear operation which is enforced per pixel and is used to replace all the negative pixel values in the activation/feature map by zero. So basically the goal of using ReLU is to introduce non-linearity in our convolutional network.

Pooling

Pooling refers to decreasing the measurement of each activation map but still it keeps the most valuable information.

Pooling layers are inserted in between the convolutional layers periodically in the network, the main goal of the pooling layer is to decrease the spatial size of the maps and hence it decreases the computations in the network because now we have less pixels to deal with.

The most commonly used pooling layer is max pooling layer with the filter of size 2 x 2, which slides over each 2 x 2 part of the previous map and takes the maximum value from each and every part to generate another feature map with up to 75% less pixels / activations as shown in the figure below.
Now as we are able to detect high level features at the end of the network a thoroughly connected layer is attached. The input of this layer is the output of the layer prior to it and it gives an output of N dimensional vector where N is the number of classes in which the computer has to classify it. In our example N is 2 as there are only two such classes to choose from that are dogs and cats. Each number in this dimensional vector obtained as an output gives the probability of a certain class. For example, if the resulting vector of the network is [.1 .90] it means that there is 10% probability that the image is of a dog and 90% probability that the image is of a cat. [12]

E. Working of the fully connected layer

As in our example, if the program makes a prediction and gives the output of the image as a cat it will have high values of the features such as paws and legs. Therefore we can also say that the thoroughly connected layer basically look for the high level features that belong to a specific class.

F. Training the Network

So basically to tell our networks what filters to use for edge detection in images and the thoroughly connected layer to tell what activation maps to look for and for that we need to do a training process also called backpropagation.[4]

Now before a CNN starts the filter values (weights) are randomized. Now to train the network we should have a training set which contains 2000 images of dogs and 2000 images (numbers may differ) of cats and each image is labelled with its class.[5]

So the training process / backpropagation is divided into 4 parts that are 1. Forward pass 2. Loss function 3. Backward pass and 4. Weight update

The training process of the network can explained in steps as

1. All the filters and weights are initialized with random values.
2. An image is selected from the training set which contains many images with their labels as is given to the network as an input. This image is passed through all the layers all the layers explained above (convolutional, Relu, pooling and fully connected layer) and gives the output probability for each class.
3. Now total error at the output layer is calculated (summation of both the classes)

\[
\text{Total Error} = \sum \frac{1}{2} (\text{target probability} - \text{output probability})^2
\]

KERAS

To create our own convolutional neural network to classify images of dogs and cats we have used Keras which is an open source neural network library, written in python. It is capable of running on the top of Tensorflow, CNTK or Theano.

It was developed with a focus on enabling fast experimentation with deep neural networks.

It was developed as a part of the research effort of project ONEIROS (Open –Ended Neuro-Electronic Intelligent Robot Operating System). Its primary author and maintainer is Francois Chollet, a Google engineer.[13]

A. Features of Keras:

- **User-Friendly**: It minimizes the number of user actions required for common use cases, it offers consistent & simple APIs. Keras believes in
reducing cognitive load.

- **Modularity**: A model is understood as a sequence or a graph of standalone, fully-configurable modules that can be plugged together with as few restrictions as possible.

- **Easy extensibility**: To be able to easily create new modules allows for total expressiveness, making Keras suitable for advanced research.

- **Work with Python**: Models are described in Python code, which is compact, easier to debug, and allows for ease of extensibility.

There are two ways to install Keras:

- Install Keras from PyPI (recommended): sudo pip install keras
- If you are using a virtualenv, you may want to avoid using sudo: pip install keras
- Alternatively: install Keras from the GitHub source:

First, clone Keras using git:

git clone https://github.com/keras-team/keras.git

Then, cd to the Keras folder and run the install command:

Cdkeras sudo python setup.py install

**Conclusion**

With the help of machine learning we can create convolutional neural networks and can train them to classify images into groups. This technique is very helpful as it gives us a way to train a computer to recognize images and objects in images. Neural networks can be used in scene detection it may also be used in facial recognition techniques and can be used to filter images containing inappropriate content. When compared to other traditional methods of image classification it is observed that CNN gives better accuracy and results. CNNs are also fast as we can save the weights obtained in the training process and hence we have to train the network only once.

**Ethical Clearance** - Not required

**References**


**Source of Funding** - Self

**Conflict of Interest** - Nil


[13] Installation Of keras https://keras.io/#installation
Fraudulent Loan Prediction using Machine Learning Algorithms

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Abstract

There are many frauds that are being done by the people in loans. So, here concern is about fraud loan risk which is common in banks based on various attributes. This work predominantly focused on prediction of fraud loan risk. Fraud loan risk is predicted using classification techniques in machine learning. By detecting the risk of fraud loan will support the bank for early prediction of this risk will be useful. Various data mining classification approaches and machine learning algorithms are applied for prediction of fraud loan in banking dataset. In this study, the dataset of fraud loan is experimented to explore the data mining algorithm to find outperforming algorithm.

Keywords: Machine Learning, Algorithm, Preprocessing, accuracy score, confusion matrix, classification report

Introduction

Fraud loan cases are seen everywhere and these cases have become so prevalent that it is high time to control them. There are many databases collected and have been put aside for analysis. Nobody has time to analyze this data because it has been collected in thousands of numbers, but if it has to be controlled, then it is very necessary to first analyze.

The data collected and analyzed in this paper through machine learning, contains 13 attributes i.e. Loan ID, gender, married, dependents, education, self-employed, applicant income, co applicant income, loan amount, loan amount term, credit history, property area, loan status. The data is both nominal and numerical.

First the numerical data is analyzed, then nominal data is converted to Boolean values and the complete data is analyzed to note down the results and the observations made.

Machine Learning

It is an application of Artificial Intelligence (AI) which provides the ability to learn automatically. It is done by doing many errors and then learning and improving from those errors. All of this is done without being programmed explicitly. Difference between traditional programming and machine learning is shown is figure 1.

![Fig.1. Traditional Programming v/s Machine Learning](image-url)

Mainly, machine learning is of 3 types:

Supervised- An inferred function is produced by the learning algorithm from the analysis of the known dataset so that predictions can be made about the output values for future dataset. The system is trained such that it can provide the target for any new dataset and the output is compared with correct and intended.

Unsupervised- It is used when the algorithm has to learn from plain examples without any related responses. It is left on the computer to determine data patterns and relationships on its own. It restructures the data into something which consists of new features. The system may not figure out the correct output but it explores the dataset thoroughly and draw inferences to describe hidden structures from unlabeled data.

Reinforcement- It occurs when algorithm is presented with examples that lack labels, as in unsupervised
learning, but an example can be accompanied with positive or negative feedback according to the proposed solution by the algorithm [5]. It is used in applications where the algorithm must make decisions which have consequences. This can be understood as learning by trial and error.

Method of Preprocessing

A. Feature Selection

Selecting some features which are relevant to the output and discarding all the irrelevant features. For e.g. If there is a need to know the mileage of the car then top speed and engine capacity are the essential features whereas color of car will be discarded [3].

B. Feature Extraction

The new number of attributes may be less, equal or more than the original number of attributes. So this method reduces the number of attributes.

If there is image data then each image can be made of 1000s of pixels, therefore algorithm applied to it may be inefficient. In this case, features like color histogram, pixel counts and symmetry. Some advanced methods are convolutional neural networks.

If there is text data then the methods to extract information out of text data are count vectorizer, tfidf vectorizer, word embedding etc. In this, the nonnumeric data is converted to numeric by using Boolean values for e.g., female and male can be represented as 1 and 0.

C. Dimensionality Reduction

In this the number of attributes go on increasing. This is the problem due to the curse of dimensionality where the model gets tougher to train as the dimensions of attributes increases. The methods used in this case can be:

- Principal Component Analysis(PCA)
- Singular Value Decomposition(SVD)

It helps to visualize the data better because it becomes harder to visualize at higher dimensions.

Algorithms

This dataset falls under supervised machine learning. Since the prediction has to be made on whether the loan is fraud or not, classification algorithm will be used [4]. The main goal of the classification is to predict the target class. The main goal of regression is to predict the discrete or continuous values.

D. K-Nearest Neighbor

It stores the entire training dataset and then searches to find the k most similar training patterns while making a prediction. It is a simple algorithm, but it only checks the distance between the data instances to make the prediction, other than that nothing else is looked about the problem [10].

E. Decision Tree

In this a tree is created to analyze the instances of the data by starting from the root of the tree and then later moving on to the leaves, until prediction can be made [6]. The tree splits into branches or edges (outcome of test) on the basis of the condition of internal node (test), the end of the branch which does not split anymore is called leaf/decision (class label).

F. Support Vector Machine

It was built for numerical input variables, it has a feature of converting text values to numeric values automatically and normalizing the data before using it [8]. The algorithm finds a line which is the best for separating the dataset into 2 groups, which is done by using optimization process that only considers training dataset closest to the line.

G. Logistic Regression

In this algorithm, the values are assumed to be numeric and they may or may not have Gaussian (bell curve) distribution. It builds a coefficient for each input, which combine linearly into a regression function and is transformed using logistic function.

H. Naïve Bayes

It uses the implementation of Bayes theorem where prior probability is calculated from the training dataset for each class and it is assumed to be conditionally independent of each other [7].

This assumption being unrealistic (as instances need to be interactive and dependent) still make the probabilities fast, easy and effective.
I. Random Forest Classifier

As the name suggests, it builds a forest and somehow makes it random. The forest is generated by building multiple decision trees and merging them. This technique provides more accurate and table results.

J. Linear Discriminant Analysis

It is a technique which is used to find the available instances from the given dataset to separate the classes. The main purpose of this technique is to reduce the number of classes or the dimensions so that the computational cost is decreased, after this technique is applied to the given dataset, the new features minimizes the dispersion between same classes and maximizes the dispersion between different sets of classes.

Dataset Description

This study makes use of the dataset from the UCI Machine Learning Repository named fraud loan uploaded in 2015. This dataset has 13 attributes out of which 7 are numeric and 6 nominal. The attributes and its description is mentioned in Table I. Total 614 instances of the dataset is used for the training to prediction algorithms.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loan_ID</td>
<td>Numeric</td>
</tr>
<tr>
<td>2</td>
<td>Gender</td>
<td>Text</td>
</tr>
<tr>
<td>3</td>
<td>Married</td>
<td>Text</td>
</tr>
<tr>
<td>4</td>
<td>Dependents</td>
<td>Numeric</td>
</tr>
<tr>
<td>5</td>
<td>Education</td>
<td>Text</td>
</tr>
<tr>
<td>6</td>
<td>Self_Employed</td>
<td>Text</td>
</tr>
<tr>
<td>7</td>
<td>Applicant Income</td>
<td>Numeric</td>
</tr>
<tr>
<td>8</td>
<td>Coapplicant Income</td>
<td>Numeric</td>
</tr>
<tr>
<td>9</td>
<td>Loan Amount</td>
<td>Numeric</td>
</tr>
<tr>
<td>10</td>
<td>Loan_Amount_Term</td>
<td>Numeric</td>
</tr>
<tr>
<td>11</td>
<td>Credit_History</td>
<td>Numeric</td>
</tr>
<tr>
<td>12</td>
<td>Property_Area</td>
<td>Text</td>
</tr>
<tr>
<td>13</td>
<td>Loan_Status</td>
<td>Text</td>
</tr>
</tbody>
</table>

Steps followed in the data analysis:

- The attribute Loan_Status is taken as target value.
- The attributes which have value 0 are replaced with NaN
- All the numeric values are taken and stored in the variable xcopy. Loan ID is not taken as it represents the ID of the each loan and is not used for computation purpose. Dependents and Credit_History attributes are not taken as it only has 0 and 1 values.
- Data preprocessing is performed by Imputer which replaces the NaN values by the mean values.
- K-NN algorithm is applied on numeric data and the accuracy score is determined.
- Through label encoder non numeric data is converted to numeric form by using Boolean values.
- All the data is concatenated which has both numeric and non numeric values and it is stored in the variable X.

CODE FOR PREDICTION

The seven kinds of algorithms which were applied to the dataset are k-Nearest neighbor, Decision Tree Classifier, SVC, Random Forest Classifier, Linear Discriminant Analysis, Logistic Regression, Gaussian NB.
RESULTS AND DISCUSSIONS

K. Confusion Matrix

It is a 2x2 matrix in which predicted yes value and actual yes value i.e. True Negative is stored in row 1 and column 1, predicted no value and actual yes value i.e. False Positive is stored in row 1 and column 2, actual no value and predicted yes value i.e. False Negative is stored in row 2 and column 1, predicted no value and actual no value i.e. True Positive is stored in row 2 and column 2.

The values of confusion matrix obtained from the seven algorithms are mentioned in Table II.

<p>| TABLE II. CONFUSION MATRIX                        |
|----------------------------------------|--------|--------|--------|--------|</p>
<table>
<thead>
<tr>
<th><strong>Algorithm</strong></th>
<th><strong>True Negative</strong></th>
<th><strong>False Positive</strong></th>
<th><strong>False Negative</strong></th>
<th><strong>True Positive</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision Tree Classifier</td>
<td>35</td>
<td>37</td>
<td>27</td>
<td>104</td>
</tr>
<tr>
<td>SVC</td>
<td>33</td>
<td>39</td>
<td>2</td>
<td>129</td>
</tr>
<tr>
<td>Random Forest Classifier</td>
<td>43</td>
<td>29</td>
<td>18</td>
<td>113</td>
</tr>
<tr>
<td>Linear Discriminant Analysis</td>
<td>34</td>
<td>38</td>
<td>2</td>
<td>129</td>
</tr>
<tr>
<td>Logistic Regression</td>
<td>33</td>
<td>39</td>
<td>2</td>
<td>129</td>
</tr>
<tr>
<td>Gaussian NB</td>
<td>35</td>
<td>37</td>
<td>6</td>
<td>125</td>
</tr>
<tr>
<td>k-NN</td>
<td>29</td>
<td>43</td>
<td>10</td>
<td>121</td>
</tr>
</tbody>
</table>

L. Performance Evaluation

The results obtained from confusion matrix help to get the best algorithm. F1 Score is $2 \times \frac{(Precision \times Recall)}{(Precision + Recall)}$. The results are shown in Table III.
TABLE III. PERFORMANCE EVALUATION

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Accuracy</th>
<th>Precision (TP/ (TP+FP))</th>
<th>Recall (TP/ (TP+FN))</th>
<th>F1 Score</th>
<th>Support (TP+FP) (FN+TN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision Tree Classifier</td>
<td>68.47</td>
<td>0.68</td>
<td>0.68</td>
<td>0.68</td>
<td>203</td>
</tr>
<tr>
<td>SVC</td>
<td>79.80</td>
<td>0.83</td>
<td>0.80</td>
<td>0.78</td>
<td>203</td>
</tr>
<tr>
<td>Random Forest Classifier</td>
<td>76.84</td>
<td>0.76</td>
<td>0.77</td>
<td>0.76</td>
<td>203</td>
</tr>
<tr>
<td>Linear Discriminant Analysis</td>
<td>80.29</td>
<td>0.83</td>
<td>0.80</td>
<td>0.78</td>
<td>203</td>
</tr>
<tr>
<td>Logistic Regression</td>
<td>79.80</td>
<td>0.83</td>
<td>0.80</td>
<td>0.78</td>
<td>203</td>
</tr>
<tr>
<td>Gaussian NB</td>
<td>78.81</td>
<td>0.80</td>
<td>0.79</td>
<td>0.77</td>
<td>203</td>
</tr>
<tr>
<td>k-NN</td>
<td>73.89</td>
<td>0.74</td>
<td>0.74</td>
<td>0.71</td>
<td>203</td>
</tr>
</tbody>
</table>

M. Graphical Representation

In the above graph, 0 represents Applicant Income, 1 represents Coapplicant Income, 2 represents Loan Amount and 3 represents Loan_Amount_Term.

The outputs are compared and is listed in Table IV.

TABLE IV. BEST AND WORST ALGORITHM

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Accuracy</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDA(Linear Discriminant Analysis)</td>
<td>80.29%</td>
<td>Best</td>
</tr>
<tr>
<td>Decision Tree Classifier</td>
<td>68.47%</td>
<td>Worst</td>
</tr>
</tbody>
</table>

Conclusion

All the algorithms are applied on the data and the best and worst algorithms are mentioned. Therefore, for loan prediction, LDA gives the best results. The data is analyzed by first applying algorithm on numeric data, then applying 7 kinds of algorithms on concatenated data.

Ethical Clearance - Not required

Source of Funding - Self

Conflict of Interest - Fraudulent Loan Prediction using Machine Learning Algorithms

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Big Data Analysis Applied for Short Term Solar Irradiance Forecasting

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Abstract

An improvement of accuracy in Forecasting of Solar Weather requires more specific parameters. Parameters that are feasible to implement and the collected data to be ready to be blended and because of this, the parameters need to be easy to use and its of prime importance that it remains the case. In this case giving our focus on getting the pollution parameter in order to make a module that will integrate with an existing solar weather prediction system. The module takes in pollution data uses the light beams reaction to the particulates per million content and its characteristic reaction to compound that’s classified as a pollutant or a heavy molecule. It is getting the data about the light beams hitting the surface below the cloud cover, and that gives an output of energy that’s hitting the ground to suncast system.

Keywords— big data; suncast system, weather forecasting; renewable energy; light diffraction coefficients; solar irradiance;

Introduction

Solar forecasting is a buzzword that has been used in the data industry that’s used to describe the fact that modern technology has enabled the prediction of natural phenomenon. Previously it was unthinkable that any event from the future is predictable, now processing power and that power in a portable format has enabled data gathering and the option to custom fit parameters and mine it on the particular location itself. The whole system is called the suncast system, it uses a variety of modules to determine the solar weather forecast for a short time scale into the future, this project deals with a specific module that is called the nowcast solar weather prediction system and its individual segments. As we are looking to improve the accuracy of the short range solar weather, we are integrating another module that is like an addon to the current nowcast system. Improving the current system by integrating features of light diffraction by aerosol spreads across a small area. Forecasting Of Solar Weather is a complex scientific and computational challenge. From the time before modern computing, Data Scientist and meteorologists have been very keen to apply the science of analytics and numerical methods to improve accuracy of forecasting.

From that time the depth of the data included in the numerical models along with the indepth detailing used have grown drastically, regularly challenging the accessing performance of each era. At the very same time the field has been comfortable and friendly enough technological developments to engage superior analytical and processing knowledge procedures. Recent weather forecast procedures have hit a lot difficulties along the way, and a specific challenge comes in respect of real time data gathering and mining data, and many processes support on its standard, adding, Countries defence procedure, energy standards and extended. To meet those demands, prediction models are run on hour to hour basis for numerical weather prediction of weather.

At a high depth and detailed setting, and include Hundreds of millions of cells, include science equation parameters in contents that resolve their equations. The scientific content offer good framework to understand and use for phenomenon of, lighter and indepth resolution, end layer turbulence, the incident and
deflected radiation, the physical nature of the cloud and land surface interaction with the fluid atmosphere, among other parameters.

The fluid equations are predictable only to degree, indicating sensitivity to the conditions initially. We can deal with this using two specific methods in countering the volatile nature of data for modeling atmospheric flow: assimilation and ensemble prediction. Assimilation is the process of blending, pre-processing and combining observed data into the starting model state using the right parameters. Such data is not often located on the grid and sometimes can’t be compared in respect to that the nature of the data, taking an educated guess in attempts to measure the depth and height of the atmosphere. Ensemble modelling embraces the volatile nature of the flow and seeks to provide all kinds of plausible versions of the development of the specific weather event. Weather centres use the above members to form a pdf or Probabilistic density type function.

Sources in order to have clearer picture of the deterministic forecast and additionally to also quantify its uncertainty. Training such type of postprocessing methods requires a Gigantic amount of both initial data that is accurate and observational data that is easy to access and is put forth down below. One of the more effective methods involves rich data mining procedure that combines unique computational predictions with knowledge of the physics and dynamics of the system.

An example of such application that calculates and accommodates for all of these data issues is forecasting for variable renewable energy, namely solar power. Accurate forecasting of renewable resources is of prime importance in order to reduce the cost of renewable energy and effectively and with assurances of output integrate these variable energy source into electric grid operations. Government Power systems and independent system operators that also supply power to the grid rely on such predictions to blend this unreliable yet valuable resource into the energy system. They need to ensure their resources are available a day or more ahead and correct predictions of the cheap sources of renewable energy allows minimizing cost of producing such energy while also giving assurances, that sufficient power will meet the expected output. Output is predicted specific for the cases like wind that is expected at the blades of the turbine, or the sunlight hitting the photovoltaic cells in terms of Kilojoules.

This paper describes a module to be used in synchronization with the existing weather prediction system comprising of how the data is used for our benefit.

RELATED WORK

Suncast Weather Research Forecasting

WRF solar is a modified version of weather research forecast model that is currently being used by Countries all around the world[1]. This System uses a variety of modules to pull data streams from various Weather stations (Solar weather in particular) around the country. Data streams for temperature, time of day, wind direction, cloud cover, Cloud cover imaging are all complex measurements to which no simple solution exists. They are complicated applications of big data, and we are taking this system to improve. In our project, its called Suncast Solar Weather forecasting system.

Big Data analysis of weather forecasting system

Application of Big data to understanding of natural weather phenomenon can only be done by using the right tools and especially the right equations. Accuracy in Data collection and appropriate parameters (equations and such) are of paramount importance[2]. This paper analyses the Current Weather Prediction Systems and projects and how they handle large quantities of incoming quality data. Big data storage and how they are flagged and corrected are shown in this paper apart from how to use it respective to weather applications.

REAL-WORLD WEATHER FORECASTING FROM A PERSPECTIVE OF BIG DATA.

Data Capacity

Data Capacity is a rudimentary challenge in Numerical Weather Forecasting Applications like processing large wave of data that is observed for integrating into the models and solves the Physics Package equations on grids exceeding 100million grid divisions with time gap of 20s[3,4]. This tells us that data of 18 billion bytes of each model variable is handled hourly. This demonstrates that data capacity is problem for weather forecasting and further improvement can be helpful.

Data Changeability

The data that is mixed to provide a forecast usually includes a variety of readings, some of which take
accommodate for the variables on the surface at locations that rarely correspond with the points on the grid standardized by the corresponding countries National Center for weather research, where as others depict the vertical profile of the surroundings of a particular locations.[9] Therefore, all of these differing types of data with differing types of grid systems must be synchronized so as to provide a legible photograph of the weather at that particular instance of time before it is integrated into prediction system for weather phenomenon. Standards for collection of weather data exist and as Standardization is an efficient tool for development of accurate, robust, and error free renewable energy forecasting systems.

Data Speed

Big quantities of data being received on different timescales creates a huge challenge for processing the data. In order for a full system to operate, we must prepare delay in the incoming time of the different NWP model and each source of observation.[6] This means that as the data arrives, the valid time needs to be attached and procedures need to be implemented for any lags before integrating it with data from other systems.

Data Variability

The reality of receiving the different data types as the day progresses tells us that we must have contingencies for any of the data sources to not reach at convenient time and have plans for when the accuracy falls down when certain sources of expected data are not available in time to provide the real-time prediction.[7,8] As this is an event that occurs more times than expected, fallout routines are necessary for each type of data that may be missing. Due to fact that the machine learning algorithms are retrained to optimize on having all the data, it is necessary to also provide forecast model systems that assume missing data based on the pre-existing readings and trends. On a side note that this process become seven more complex when more than a single type of data is missing at the time that the forecast must be delivered.

Data Accuracy

Data quality is an issue that cannot be ignored when training the computational intelligence models even more so in real-time. We need to ensure this for the models so that the first instance and relationships with each other can be as strong as possible.[9,10] There are frequent issues with incorrect data that must be reconciled with. For instance, there is set of expected temperature values and when an observation is far from the expected range for these as on and time of day at a location, it can be flagged for potential error.

An additional check could be made on the previous value of temperature to see differences for time stamps is within reason. All possible situations ought to be accounted for to ensure data accuracy, we have to take factors of the weather, events such as floods and thunderstorms often give spiked values for humidity, temperature[11].

THE POLLUTANT PROCESSING MODULE

The Pollutant Processing module is the module which we are preparing, its coded in php. This module is made so that it gets the data stream of pollutant data from the closest weather station that’s close to the inputted GPS co-ordinates. It uses those pollutant data, which stretches back to three days at the very least. The pollutant data is an indicator of the air quality of surrounding area; the module accepts the data which is a combination of Ppm data of pollutants such as NO, CO2, CO, and the time of day of the readings.

We use the light diffraction equations to combine the data accepted with certain coefficients such as aerosol scattering coefficient (sigma-p) (For Optical properties), and the scattering Angstrom coefficient is for the more subtler properties of the compounds. These parameters used give a fair idea of the light hitting the floor after it has passed the cloud surface layer in terms of Kj/Kilojoules/Energy. This when used in tandem with the sun cast systems already existing modules will add a depth in solar energy measurement accuracy. This way we can account for how much useful light is actually hitting the surface. An Anthropogenic Aerosol is an air suspended particle that is released by Human activities. These particles can be in all forms going from solid/liquid in the form of drops, or gases suspended in the atmosphere. Any process that’s natural and releases aerosols into atmosphere is a primary pollutant else it is classified as secondary.
Our Module deals with the data by pulling it from, In our case a local weather station located in IIT, Madras. The data pulled is described in the diagrams above (Temperature, Wind Direction, Particulate Description), But for our sample module because of cost concerns we are doing the data blending for a sample area of near our area of stay alone.

**EQATIONS USED**

\[ N.A(1)=4 \pi (\mu - 1)^2/(N \lambda^4). \]

\[ A(\mu,\lambda)=-\ln((AOD((\mu)/(AOD(\lambda)))/\ln(440\text{nm}/\lambda)) \]

Here

\[ N \] is the number of molecules in a unit volume (Parts Per Million)

\[ \lambda \] is the wavelength of the incident light.

\[ \mu \], For this instance is the refractivity of the anthropogenic compound.

AOD stands for Optical Depth A Is the Columnar Angstrom Coefficient-It is a quality indicator for the physical dimensions of the compound.

These are not constant and are dependent on the daily particle size and amount, this is what we take from the weather station along with the other data.

The wavelength specifications (nm- nanometers) is taken according to the data available.
The irradiance forecasts of the DICast and Nowcast systems are processed in the transition times that can take from two to six hour, to produce solar weather forecasts for every 15 min to about 3 hours then can be stretched further if required. The forecast variable is known as GHI, which is most useful for solar panel operations.

**Conclusion**

We conclude by saying that the pollutant module that is an add on to the suncast solar prediction system implements a level of depth to the data measurements that help us increment the precision of short term solar weather prediction systems. The nowcast system In this case is focusing on getting the pollution parameter in order to make a module that will integrate with an existing solar weather prediction system. The module takes in pollution data uses the light beams reaction to the particulates per million respective to each compound that’s classified as a pollutant. It is getting the data about the light beams hitting the surface below the layer of cloud, and that gives an output of energy that’s hitting the ground to suncast system. This is required in order to attain a usable figure for the amount of solar insolence.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** - Nil

**References**


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Dual Watermarking Technique for Protection of Images

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¹Student, Amity University, Uttar Pradesh, ²Amity University, Uttar Pradesh

Abstract

Image watermarking is a tool used for authentication, ownership, intellectual property protection and many other security aspects of e-data. Dual watermarking is effective and efficient to prevent attacks, because it uses a private key and a public disordered mixing algorithm for the recovery of images. This can be a good way of protection of copyright and authenticity of images. In this paper, dual watermark scheme for protecting images is proposed, which provides a better way of protection of images against copyright infringements than the regular watermark technique.

Keywords— Dual Watermarking (DWT), Image watermarking, watermarking techniques.

Introduction

Copyright Protection is an important domain, as the internet is expanding rapidly and so is the ease of availability of digital media. This easy availability also results in higher risks of copyright infringement, thus to protect the visual data, multiple methods of copyright protections have been introduced in a past decade, but Digital Watermarking has proven to be the best because of its effectiveness. But even Digital Watermarking has some drawbacks. That is where Dual Watermarks come into play Dual Watermark is more secure and reliable than just the ordinary watermark.

Dual Watermark as the name suggests has two layers of watermark.

Visible Watermark: It is a digital watermark that is visible on the media. This is the common watermark that is widely used in form of an image overlay placed over the original image. This helps in maintaining the authenticity of the image.

Invisible Watermark: This is embedded in the code of the image and watermark is placed inside the code of the image using certain algorithms. The watermark is not visible in the original image, but the source code of the image has the retained watermark.

It double checks the security of an image hence making it more protected and less prone to copyright infringement. Since in today’s digital world the availability of images is just one search away. Dual watermarking makes the image almost impossible to steal since there is not just a physical watermark but there is one embedded in the code of the image as well. Fig. 1 shows the basic format of how dual watermark works.

![Fig. 1: Working of dual watermark](image)

The authenticity and integrity of images can be guaranteed by using Dual watermarking. The digital watermark is a data string associated with the code of image and the visible watermark is usually an organization’s logo which can be recognized by the host image. It is easy to tamper but the watermark present inside the code is hard to gain access to and cannot be tampered easily, even after attempting to tamper the image.

Based on the way of applying watermark, they are classified into two main domains:-

Frequency - The watermark is designed to be hidden in certain frequency regions of the image to provide robustness to the watermark
Spacial – In spacial domain, the watermark is placed in the code of certain space of pixels. It uses the method of Least Significant Bit insertion.

Algorithm Used

The algorithm performs two level decomposition with the use of Haar wavelet filters. If the watermark is embedded in high frequency region, the data will be divided into higher quantization value. On the other hand if watermark is stored in the lower ferequency region then it is very prone to destruction.

The original image of a certain resolution (eg. 256*256) is a resized resolution of image is taken (eg. 110*110) and is decomposed into two resolution levels using Daubechies-4 filter as shown in the following Fig. 2.

Fig. 2: Decomposition into resolution levels using Daubechies-4

A psuedo random noise order w2(i,j) having a length of 1024 bits and zero mean is produced and further to the horizontal coefficients (HL2) of the decomposed main watermark image, as per equation (1).

\[ w_1(i,j) = I_2(i,j) + w_2(i,j) \] ……….. (1)

Where w1 (i,j) represents the DWT coefficients.

The result of w1 (i,j) coefficients are further incorporated to the horizontal, vertical and diagonal DWT coefficients (HL2, LH2, HH2), as per equation (2).

\[ I'(i,j)=I_1(i,j)+\alpha .w_1(i,j) \] ……………. (2)

In which I1 (i,j) is specifying the DWT coefficients of the original image.

Detection of Watermark

To detect the watermark in an image a sequence is applied to the test image. The image I1(I,j) and the coefficients can be removed using formula:

\[ w_1(i'j)=[I'(i,j)-I(I,j)]/ \alpha \]

Cross correlating the main image with the watermarked image the embedded sequence is one of the watermarks codes w2 (i, j) and can be easily perceived.

The purposes to process the image in a smart way. Even after tampering the watermark (located in circles) the same watermark can extract as the original one. The detection is created on Weber Law.

Weber Law is also known as Threshold vs Intensity and it defines the increment ration and relation between the measure and intensity, where the background intensity is constant [2].

Weber Descriptors (WDs) have two descriptors:
1. Differential Excitation \( \chi \)
2. Orientation \( \lambda \)

This provides a approach to establish data matrix into a non overlapping blocks. The formed image has an influence of cover image by using a watermark as a private message.
Process of Watermarking

A. Embedding of Watermark

In embedding phase, a watermark is generated and then embedded in the pixel center for respective block from the original image. The process takes place as following steps:-

(i) The image is split into 3*3 blocks

(ii) Weber differential excitation is descriptor is calculated for each block

(iii) The values obtained above are measured as watermark images.

(iv) For separately block, the center pixel is chosen and is embedded with the watermark.

Algorithm I: Generate watermark Image

INPUT: I, original image
OUTPUT: w, watermarked image
Read the original image.

Reshape the original image into overlapping blocks of size 3 x 3.

(i) The watermark value of respectively block’s center pixel is calculated

(ii) Based on innovative watermark, the authenticity is evaluated.

(iv) The tampered blocks are localized in the watermarked image

Algorithm II: Extraction process

INPUT: I, attacked watermarked image, w, original watermark, a, alpha
OUTPUT: w!, attacked watermark
Read the watermarked image
Read the watermark image
Set alpha to 0.98
newrow=2;
newcol=1;

for r=1:size(I)/3 # number of rows
    for c=1:size(I)/3 # number of columns
        w!(newrow,1) = (1-alpha)* w(newrow,1) + alpha*w(newrow,newcol);
        w!(newrow,newcol+2) = w!(newrow,newcol+2);
        newrow = newrow + 1;
    end
    newcol = newcol + 2;
    newrow = newrow + 3;
end

save w! as image

C. Efficiency

To determine the efficiency, the obtained results are compared to the work present previously in the images which is based on quality of image and its robustness.

D. Quality of Image

The quality of watermarked images using Dual Watermark is found to be around 65 dB.

E. Robustness of Image

The normal watermarked images have a quality score of around 45 dB which is significantly less than what Dual Watermarking proposes.

B. Extraction of Watermark

The approach of Dual Watermarking is semi-blind. The extractor will not be provided with the original image [1]. The watermarked image is tampered in an intellectual way, in which the extractor cannot control visual changes and the image is free of any modification.

The extraction process takes place as following:-

(i) The image is divided into 3*3 blocks.
Results

The performance of the technique proposed is judged by extensively applying it to various images and attempting diverse attacks on it.

The primary watermark which is the regular visible watermark failed many tests but the secondary watermark which is the embedded watermark was still detectable after a number of attacks. Furthermore the watermark was detectable even when the image is passed through a low pass filter.

The experiments show that as long as the image is not destroyed completely, the watermark can be detected using the proposed algorithm. The watermarking doesn’t effect the quality of image even if the tampered area is really large.

The superiority of watermarked image is around 65dB which compared to other watermarking methods is significantly better, has better compatibility and is easy to recover especially when tapered area is large.

Conclusion

In this paper, the scheme of Dual Watermark for images has been proposed. This scheme provides a better way of protection of images against copyright infringements than the regular watermark. The results found in the experiments done demonstrate that this method of Dual Watermarking is very effective to prevent attacks. This method is efficient because it uses a secret key and a public chaotic mixing algorithm for the recovery of image. This can serve as a good means of protection of copyright and authenticity of the image.

Ethical Clearance - Not required

Source of Funding - Self

Conflict of Interest - Nil

References


Enabling Cloud Data Service Security with Key Exposure

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Abstract

Distributed storage evaluating is seen as an essential administration to check the honesty of the data publically cloud. Current evaluating conventions territory unit all bolstered the customer’s mystery key for examining is totally secure. In any case, such suspicion may not persistently be charge, because of the probably frail feeling that all is well with the world and additionally low security settings at the shopper. On the off chance that such a mystery key for examining is uncovered, the greater part of the present reviewing conventions would unavoidably wind up unfit to figure. Amid this paper, we tend to have practical experience in this new feature of distributed storage evaluating. We tend to examine an approach to downsize the damage of the customer’s key introduction in distributed storage inspecting, and gives the essential sensible determination to this new drawback setting. We formalize the definition and along these lines the security model of examining convention with key-presentation versatility and propose such a convention. In our style, we tend to utilize the parallel tree structure and in this manner the pre-arrange traversal strategy to refresh the key keys for the shopper. We conjointly build up a remarkable appraiser development to help the forward security and subsequently the property of piece less evidence. The wellbeing verification and subsequently the execution examination demonstrate that our anticipated convention is secure and temperate.

Keywords: Conjointly, Traversal, Exposure, Auditing, Investigate.

Introduction

Distributed computing could be a processing worldview, wherever a curiously large pool of frameworks square measure associated secretly or open systems, to deliver progressively ascendable foundation for application, data and record stockpiling. The huge amount of information is hang on inside the cloud. To confirm the Trustworthiness of data that is hang on the cloud, the distributed storage inspecting is utilized. Reviewing is relate uprightness sign in the cloud data base. It’s a critical Checking inside the cloud inspecting conventions that square measure to a great degree inquired about on late years. Each convention go about as a remarkable reviewing component. The point of acquainting the convention is with acknowledge high data measure and calculation intensity. Along these lines amid this task Homomorphic Linear appraiser (HLA) is utilized for relate practical reviewing topic. The intensity of the (HLA) system is, it bolsters piece less confirmation. Its acclimated scale backs the overheads of calculation and correspondence evaluating. The evaluator is utilized to confirm the respectability of the data in cloud while not recovering the aggregate information. The security assurance of learning is an essential feature of distributed storage examining. It’s acclimated downsize the procedure Weight of the customer. The outsider reviewer is acquainted with help the customer to sporadically check the honesty of information in cloud. Reviewing conventions square measure for the protection of information in cloud.

Related Work

Evaluating conventions may bolster dynamic data tasks. Elective angles, similar to intermediary inspecting, client repudiation and taking out authentication administration in distributed storage reviewing have conjointly beenconsidered. though’ a few examination works with respect to distributed storage evaluating are depleted late years, an imperative security drawback
introduction drawback for distributed storage inspecting, has stayed obscure in past inquiries about. While every single existing convention have practical experience in the flaws or deceptive nature of the cloud, they require unmarked the feasible feeble feeling that all is well with the world and additionally low security settings at the purchaser. Tragically, past evaluating conventions neglected to mull over this imperative issue, and any presentation of the customer’s mystery reviewing key would make a large portion of the present inspecting conventions unfit to figure legitimately.

We specialize in an approach to downsize the damage of the customer’s key presentation in distributed storage reviewing. We will probably style a distributed storage inspecting convention with inherent key-presentation flexibility. An approach to have a go at it quickly underneath this new drawback setting acquires a few new difficulties to act naturally tended to beneath. Above all else, applying the typical determination of key denial to distributed storage evaluating isn’t sensible. This can be because of, at whatever point the customer’s mystery key for reviewing is uncovered, the purchaser needs to fabricate a substitution attempt of open key and mystery key and recover the authenticators for the customer’s data aforesaid keep in cloud. The strategy includes the downloading of entire data from the cloud, fabricating new authenticators, and re-transferring everything back to the cloud, which might all be monotonous and bulky.

In addition, it can’t consistently ensure that the cloud gives genuine data once the purchaser recovers new authenticators. Also, straightforwardly embracing ordinary key-developing method is furthermore not proper for the new drawback setting. It will bring about recovering the greater part of the specific records squares once the confirmation is gone before. This can be part because of the strategy is contrary with square less check. The following authenticators can’t be aggregative, bringing about deplorably high calculation and correspondence esteem for the capacity inspecting.

Proposed System

We above all else indicate 2 essential answers for the key-introduction drawback of distributed storage inspecting before we tend to offer our center convention. The essential could be an innocent determination that if honestly can’t fundamentally settle this drawback. The second could be a somewhat higher determination, which may settle this drawback anyway fuses a monstrous overhead. They’re each unfeasible once connected in sensible settings. So we tend to offer our center convention that is much more sparing than every one of the fundamental arrangements.

Naive resolution

In this determination, the shopper still uses the typical key repudiation procedure. Once the customer knows about his mystery key for distributed storage evaluating is uncovered, he can deny this mystery key and subsequently the relating open key. In the meantime, he creates one new attempt of mystery key and open key, and distributes the new open key by the testament refresh.

The authenticators of the data aforesaid keep in cloud, be that as it may, all should be refreshed because of the current mystery privileged insights presently not secure. Subsequently, the purchaser needs to exchange all his aforesaid keep data from the cloud, produce new authenticators for them exploitation the new mystery key, so exchange these new authenticators to the cloud. Clearly, it’s an opulent strategy, and devours a lot of your opportunity and asset. In addition, because of the cloud has unbelievable the main mystery key for distributed storage examining, it will have effectively adjusted the data pieces and consequently the relating authenticators. It may turn out to be appallingly troublesome for the purchaser to try and ensure the accuracy of downloaded data and accordingly the authenticators from the cloud. Along these lines, simply reviving mystery key and open key can’t fundamentally tackle this drawback completely.

Slightly higher resolution

The purchaser toward the begin produces a progression of open keys and mystery keys: (PK one, SK1), (PK 2, SK2), •, (PK). Leave them alone open key be (PK one; •; PK T) and in this manner the mystery enter in timeframe j be (SK j, • •, SK). On the off chance that the buyer transfers records to the cloud in timeframe j, the shopper utilizes SK T to work out authenticators for these documents. At that point the shopper transfers records and authenticators to the cloud. Once examining these documents, the customer utilizes PK to confirm regardless of whether the authenticators for these records region unit so produced through SK j. Once the timeframe changes from j to j + one, the shopper erases...
SK his stockpiling. At that point the new mystery’s (SK j
j+1, SKT, •, SK This determination is plainly higher than
the credulous determination. Note j from T).

METHODOLOGY and DISCUSSION

Modules:
The framework comprises of modules and risk
modules.
• Public Key and Secret Key
• File Storage
• Generate Period of Time Key
• Indexing of Files
• View Files and Transfer Files
• Auditor Public Key

Module Explanations:

Public key & Secret key: In this Module open
mystery’s created for confirmation for the client to
deliver the client determination work. The mystery’s the
private produced for each hopeful all through enrollment

File storage: The File Storage module the record
keeps for the any use of the purchaser and consequently
the document is given the decision to take a gander at
and exchange upheld the timeframe keys.

Generate period of time key: The timeframe
mystery’s produced such to utilize the document or to
perform task on that upheld time

Indexing of the files: The combination of the
documents is such determined to take a gander at the
exchange (n) or to think of key or to exchange or play out
the activity on the record.

View and transfer files: The documents will be seen
or exchange upheld the time of time key confirmation of
the client.

Auditor public key: The examiner open mystery’s
produced to play out all the activity with one key on
every one of the modules

The Key introduction versatility inside the capacity
reviewing convention isn’t completely bolstered inside
the current framework this instrument is utilized to see any
unscrupulous, such as erasing or altering some customer’s
information that is hang on inside the cloud in past eras
will all be identified, despite the fact that the cloud gets
the customers current mystery key for distributed storage
evaluating. Evaluating conventions can even help
dynamic learning tasks. Elective viewpoints, similar to
intermediary inspecting, client disavowal and disposing
of declaration administration in distributed storage
evaluating have moreover been examined. Though’ a
few examination works concerning distributed storage
inspecting are exhausted late years, a critical security
drawback introduction drawback for distributed storage
evaluating, has stayed unfamiliar in past investigates.
While every single existing convention spend significant
time in the issues or deceptive nature of the cloud, they
require unmarked the achievable powerless suspicion
that all is well and good and additionally low security
settings at the customer. Unfortunately, past reviewing
conventions neglected to consider this vital issue, and
any introduction of the customer’s mystery evaluating
key would make the vast majority of the current
inspecting conventions unfit to work effectively. We
center on how to decrease the harm of the customer’s key
presentation in distributed storage examining. We will
likely plan a distributed storage evaluating convention
with worked in key-introduction flexibility. The most
effective method to do it productively under this new
issue setting gets numerous new difficulties to be tended
to beneath. As a matter of first importance, applying
the typical determination of key denial to distributed
storage inspecting isn’t sensible. This is frequently
because of, at whatever point the customer’s mystery
key for inspecting is uncovered, the customer needs to
produce a substitution attempt of open key andmystery
key and recover the authenticators for the customer’s
information previously hang on in cloud. The technique
includes the downloading of entire learning from the
cloud, producing new authenticators, and re-transferring
everything back to the cloud, which might all be dull
and unwieldy. Also, it can’t consistently ensure that
the cloud gives genuine information once the customer
recovered new authenticators. Besides, straightforwardly
embracing standard key-advancing procedure is also not
proper for the new drawback setting. It will bring about
recovering the majority of the specific documents squares
once the confirmation is gone before. This is frequently
in part because of the method is incongruent with square
less confirmation. The following authenticators can’t be
aggregate, bringing about unfortunately high calculation
and correspondence esteem for the capacity examining.

The mystery enter in on each event sum is composed as a stack. In on each event sum, the key mystery’s refreshed by a forward secure procedure. It ensures that any authenticator created in one day and age can’t be processed from the mystery keys for some other day and age later than this one. Plus, it guarantees that the complexities of keys measure, calculation overhead and correspondence overhead are just logarithmic in all out number of eras T. Thus, the inspecting convention accomplishes key-introduction flexibility while fulfilling our intensity needs. As we will demonstrate later, in our convention, the purchaser will review the uprightness of the cloud data still in aggregative way, i.e., while not recovering the total data from the cloud. As same on the grounds that the key-advancing systems, our arranged convention doesn’t consider the key presentation obstruction all through just once sum. Beneath, we will give the cautious portrayal of our center convention. The cloud reviewing convention with key presentation flexibility convention shields the data from the unapproved client. It confirms the honesty of the data. The evaluating convention with key-introduction Resilience: AN examining convention with key-presentation versatility comprises by 5 calculations (Sys-Setup, Key-Update, Auth-Gen, Proof-Gen, Proof-Verify) demonstrated as follows.

**Implementation and Evaluation**

**SysSetup**

It is 1s the essential equation that is first setup the information parameter k and in this way the aggregate time frame T. here the parameters that utilized in this calculations are K and T. what’s more, in the end it’ll create A yield as an open key PK. This was created by the customer.

**Key Update**

It is a probabilistic recipe. It’ll take the contribution as open key pk. For meaning the present sum wherever the information to be position is use out by the parameter j. For the essential sum the present data that is indicated by the purchaser mystery’s SKj. furthermore, in this manner the following time frame the present time is indicated as SKj+1. This recipe is furthermore go past the shopper aspect.

**AuthGen**

It is furthermore named as Authentication created algorithmic program. This algorithmic program is utilized to confirm the document that should be utilized for technique. This algorithmic program is moreover created in customer viewpoint.

**ProofGen**

This algorithmic program is utilized to check the sign worth of the framework. This value is issued by the reviewer. This algorithmic program is created by the cloud angle.

**Proof Verify**

Evidence confirmation is done by the customer perspective was the verification should be wont to understand the coveted specialist or not.

Distributed storage might be a model wherever information is keep consistently and kept up that is shaped realistic to complete clients over an out estimated scale organize. The tip clients get to information from each and each a piece of the globe. Capacity outsourcing into the cloud is to a great degree plentiful esteem valuable and moreover aids unpredictability of huge scale information stockpiling for some time later. Hence but any very interruption happens provincially at the customer’s site, the data that has been transferred inside the cloud are possible for get to that the customer will exchange later. In the interim, such an administration is furthermore wiping out information proprietors honest to goodness administration as time goes on of their insight that they require truly fore threw with high administration level needs. Likewise, the huge amount of learning inside the cloud and proprietor’s limited procedure abilities more makes the assignment of capacity inspecting amid a cloud climate overrated and notwithstanding horrifying for singular buyers. Buyers
can delay to store information in cloud if it’s a matter of their insight security and honesty. Therefore, the Third Party Auditor (TPA) was presented that is nothing anyway a product framework that assumes a critical part in examining the respectability and security of the data. The TPA, is nothing anyway an outsider programming framework that has the experience and abilities that clients don’t have, furthermore it will sporadically check the respectability of the learning keep inside the cloud in the interest of the clients, that gives strategy extra less demanding and shabby route for the clients to ensure their capacity accuracy inside the cloud. Distributed storage Auditing is basically a circumstance wherever the Third Party Auditor (TPA) reviews or checks the trustworthiness of the data inside the cloud to find out if any unapproved individual or association has changed the data in any strategy since the data has been keep inside the cloud. This was a major issue since

The data might be strong as well, that if made would be undetectable to the customer. Thus, in order to keep up the validity of the data and to decrease the weight of retribution and trading data in inspecting conventions, Homomorphic Linear appraiser (HLA) procedure was examined which enables the examiner to check the validity of the information inside the cloud while not appealing the whole information. This is frequently moreover named as block less check. Numerous distributed storage inspecting conventions in like manner are anticipated on the possibility of this strategy. Barely any inspecting conventions are anticipated that backings information dynamic tasks like expansion, cancellation and change.

**Experimental Results**

**Fig.2:** User login to the system and this is the base page for system.

**Fig.3:** User should login the system to send or download the files form cloud.

**Fig.4:** User should upload the file with multiple key pair and the uploaded files are viewed in the home page.

**Fig.5:** User should upload and send the file with multiple key pair and the uploaded files are send to receiver.

**Fig.6:** User want to download the upload files from the cloud, they should enter the multiple key pairs to get the file.

**Conclusion**

We formalize the definition thus the assurance model of inspecting convention with key-presentation
versatility and propose such a convention. In our vogue, we’ve a slant to utilize the parallel tree structure thus the pre-arrange traversal procedure to refresh the key keys for the supporter. We tend to together build up a particular appraiser development to help the forward security thus the property of square less certainty. The security verification thus the execution examination demonstrate that our anticipated convention is secure and prudent. All through this paper, we’ve a slant to represent considerable authority in this new part of distributed storage evaluating. We a slant to inquire about the least difficult approach to reduce the damage of the customer’s key presentation in distributed storage evaluating, and gives the main savvy determination to this new disadvantage setting. Current inspecting conventions unit all bolstered the prospect that the customer’s mystery key for evaluating is thoroughly secure. Be that as it may, such suspicion may not interminably be order, due to the hypothetically feeble conviction that all is good as well as low security settings at the benefactor.

Cloud computing brings great convenience for people. Particularly, it perfectly matches the increased need of sharing data over the Internet. In this paper, to build a cost-effective and secure data sharing system in cloud computing, we proposed a notion called RS-IBE, which supports identity revocation and cipher text update simultaneously such that a revoked user is prevented from accessing previously shared data, as well as subsequently shared data. Furthermore, a concrete construction of RS-IBE is presented. The proposed RS-IBE scheme is proved adaptive-secure in the standard model, under the decisional ℓ-DBHE assumption. The comparison results demonstrate that our scheme has advantages in terms of efficiency and functionality, and thus is more feasible for practical applications.

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**References**


An Extensive Study for the Development of Web Pages

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Abstract

How quick does the web change? Does a large portion of the substance stay unaltered once it has been created, or the report continuously refreshed? Do pages change a little or a considerable measure? Is the degree of progress connected to some other property of the page? These inquiries are important to the individuals who mine the web, including all the famous web search tools, however few examinations have been performed to date to answer them. One striking special case is an investigation by Cho and Garcia-Molina, who crept an arrangement of 720,000 pages once a day more than four months, and considered pages having changed if their MD5 registration changed. They found that 40% of all site pages in their set changed inside seven days, and 23% of those pages that fell into the .com space changed day by day. This paper develops Cho and Garcia-Molina’s investigation, both as far scope and regarding affectability to change. We slithered an arrangement of 150,836,209 HTML pages once consistently, finished traverse of 11 weeks. For each page we recorded a checksum of the page, and an element vector of the words on the page, in addition to different other information, for example, the page length, the HTTP status code, and so forth. Additionally, we pseudo arbitrarily chose 0.1% of the greater part of our URLs, and spared the full content of each download of the comparing pages. After finish of the slither, we examined the level of progress of each page, and explored which factors are connected with change force. We found that the normal level of progress differ pages change more regularly and more extremely than littleronces. This paper portrays the slither and the information changes we performed on the logs, and exhibits some measurable perceptions on the level of progress of various classes of pages

Index Terms: Click Graph, location Boosting, Tracing Places.

Introduction

The accessible web and the web indexes which study it have turned out to be fundamental instruments for data disclosure. From academic analysts to grade school understudies, from growth dad tients to beneficiaries, from neighborhood secondary school football fans to between national explorers, the listed substance of the web is turning into the essential research instrument for some. With a huge number of people depending on these devices, one is directed to inquire as to whether the apparatuses give helpful, cutting-edge comes about. In a perfect world, one might want the whole list of a web crawler to be new, that is, to contain the most state-of-the-art form of a site page. The Google web crawler endeavors to primary train a crisp file by slithering more than 3 billion pages once per month [7], with more continuous creeps of hand-chose destinations that are known to change all the more regularly. What’s more, it offers access to reserved duplicates of pages, to forestall issues emerging from a portion of the crept URLs being outdated or having vanished completely.

To enhance the freshness of results returned via web indexes and enable them to spend a greater amount of their endeavors creeping and filling pages which have transformed, it is fascinating and vital to answer a few inquiries regarding the dynamic idea of the web. How quick does the web change? Does a large portion of the substance remain un-changed once it has been composed, or are the reports being persistently refreshed? Do pages change a little or a ton? Is the degree of progress corresponded to some other property of the page? Do pages change and afterward change back? How reliable are reflects and close reflections of pages? Inquiries like these are of extraordinary relevance to web indexes,
and all the more for the most part to any gathering endeavoring to keep up a breakthrough perspective of the web, however they are additionally enthusiastic in their own particular appropriate, as they shed light on the development of a noteworthy sociological marvel: the biggest on the whole built in-arrangement store known to man.

In this paper, we endeavor to answer a portion of these inquiries. We relate how we gathered 151 million website pages eleven times over, holding striking data including a component vector of each page. We portray how we refined the gathered information about every URL into a rundown record, classifying the component vectors. We outline the system we used to dig the refined information for measurable data. We exhibit the most intriguing results of this information mining. At long last, we make a few inferences and offer roads of future work.

Related Work

This paper develops an investigation by Cho and Garcia-Molina [5]. The creators of that review downloaded 720,000 pages drawn from 270 “well known” web servers (not surpassing 3,000 pages for every server) consistently finished the course of four months, and held the MD5 checksum of the substance (counting the HTML markup) of each page. This enabled them to decide whether an archive had changed, in spite of the fact that it didn’t enable them to survey the level of progress. In addition to other things, they found that pages attracted from servers the .com area changed significantly quicker than those in different areas, while pages in the gov space changed substantially slower. Generally speaking, they found that around 40% of all pages changed inside seven days, and that it took around 50 days for half of all pages to have changed. They additionally found that just about 25% of the pages in .com changed inside a day, and that it took 11 days for half of all .com pages to have changed. By differentiate, it took four months (the term of their examination) for half of the .gov pages to have changed.

Sunetal [11] examined the viability of web anonymizers. As a component of that review, they drew arrangement an arrangement of 100,000 website pages from the Open Directory posting, and slithered each page twice, with the second recovery promptly following the first. Since they were interested in the data spillage of encoded channels, they didn’t analyze checksums of the returned pages; rather, they com-pared the lengths of the pages and the number and lengths of their inserted pictures and edges (which will appear to a listen in per as transiently firmly divided TCP bundles). They found that 40% of pages changed marks, and that 14% of pages changed by at least 30%, utilizing a Jaccard-coefficient-based comparability metric likened to the one we utilize, yet in light of the span of a record including sizes of implanted pictures, not substance.

Douglas et al. [6] considered a web follow comprising of 950,000 en-tries (every passage speaking to a web get to) gathered more than 17 days at the portal between AT&T Labs– Research and the Internet. They recorded the “last-adjusted” timestamp transmitted by the web server (certainly accepting that web servers transmit accurate data). Likewise, they dug each page for things, for example, telephone numbers utilizing an area particular semantic anal sister strategy called “grinking”, and estimated the rate of progress of these things. They found that as indicated by the last-adjusted metric, 16.5% of the assets (counting HTML pages and additionally other substance, for example, pictures) that were gotten to numerous circumstances changed each time they were gotten to. They likewise found that among the HTML pages that were gotten to more than once, very nearly 60% experienced a change in HREF joins, and more than half of them experienced a change in IMG joins.

Brewing ton and Cybenko constructed a web cutting administration, which they utilized to examine the change rate of site pages [1]. They did as such by recording the last-adjusted time stamp, the season of download, and different complex qualities (number of pictures, joins, tables, and so on) of each downloaded HTML page. Their administration downloaded around 100,000 pages for every day, chose in view of their topical intrigue, re-slithering no page more regularly than once every three days. They assessed information gathered amongst March and November 1999. For pages that were downloaded six times or progressively, 56% did not change at all finished the length of the examination (as indicated by the highlights they held), while 4% changed each and every time.

Our investigation contrasts from past examinations in a few regards. To begin with, it covers an around 200 times bigger bit of the web (in spite of the fact that
the interim between returns to is seven times bigger than, say, the one utilized by Cho and Garcia-Molina). Second, we utilized an alternate and more fine-grained closeness metric than any of alternate investigations, in view of syntactic archive portrays [4]. Third, we chose our pages in view of an expansiveness first slither, which evacuated a portion of the inclination intrinsic in alternate investigations (in spite of the fact that broadness first creeping is known to be one-sided towards pages with high Page Rank [9]). Fourth, lastly, we held the full content of 0.1% of all downloaded pages, an example set that is similar in size to the arrangement of pages outlined by different examinations.

Experimental Setup

Our test can be isolated into three stages: Collecting the information through rehashed web slithers, refining the information to make it agreeable to examination, and mining the distillate. This area de-recorders every one of the stages in more detail.

Collecting the Data

Between 26 Nov. 2002 and 5 Dec. 2002, we played out a vast slither (“creep 1”) that downloaded 151 million HTML pages and additionally 62 million non-HTML pages, which we hence ignored. We at that point endeavored to get every one of these 151 million HTML pages ten more circumstances over a traverse of ten weeks. Normally, a portion of these pages turned out to be either incidentally or for all time inaccessible. In addition, we encountered a disastrous circle disappointment amid the third slither, making us lose a fourth of the logs of that creep. Figure 1 demonstrates the appropriation of fruitful downloads. As can be seen, we prevailing with regards to downloading 49.2% of the pages each of the eleven times, and 33.6% ten times, leaving 17.2% of the pages that must be downloaded nine times or less.

Our equipment foundation comprised of a group of four Compaq DS20 servers, every one furnished with a 667 MHz Alpha star censor, 4 GB of RAM, 648 GB of circle, and a quick Ethernet arrange association. The machines were situated at the Palo Alto Internet Exchange, a peering point for 12 Telco’s and 20 noteworthy and around 130 minor ISPs. We led these slithers utilizing the Mercator web crawler [8]. Mercator is both quick and very configurable, making it an appropriate instrument for our motivations.

We seeded creep 1 with the Yahoo! landing page. We limited ourselves to content retrievable utilizing HTTP, overlooking HTTPS, FTP, Gopher, and so forth. Mercator slithered utilizing its standard expansiveness first hunt web traversal methodology, which is one-sided towards pages with high Page Rank [9]. This slither kept running for 9 days, and downloaded an aggregate of 6.4 TB of information. As said before, it logged the URLs of 151 million HTML pages that were effectively recovered, i.e. that were come back with a HTTP status code of 200 and a substance sort of content/html.

We utilized these 151 million URLs to seed the accompanying ten creeps. These slithers ran successively, beginning on 5 Dec. 2002 and finishing on 12 Feb. 2003. We incapacitated connection extraction and HTTP redirections; as it were, we designed Mercator to get just the pages in its seed set. Each creep backed off by two requests of greatness once it had prepared everything except a million or so seeds, be-cause the rest of the URLs all alluded to web servers that were to a great degree easy back to react to us amid that slither, and on the grounds that Mercator’s respectfulness arrangements make it space out solicitations to a similar host corresponding to the deferral of the past reaction from that host. So as to keep the general length of each slither inside sensible limits, we ended the creeps after this happened, ordinarily on the 6th day of the slither, and began the following slither seven days after the beginning of the first one.

For every one of the eleven slithers, we gave Mercator two new professional cussing modules: a module that recorded an checksum and that settled sized components recorded a checksum and a settled size component vector in addition to some subordinate information for each page, and a moment module that chose 0.1% of all pages and spared them to plate.
We processed the element vectors utilizing a changed rendition of the report shingling method because of Brooder et al. [4], which utilizes a metric of report closeness in view of syntactic properties of the record. This closeness metric is relevant to any sort of document that comprises of a requested grouping of discrete highlights. The accompanying portrayal accept that the highlights are words, i.e. that a record is a requested grouping of words. To look at two archives, we delineate report into an arrangement of k-word subsequences (gatherings of adjoining words or “shingles”), wrapping toward the finish of the record, with the goal that each word in the report begins a shingle.

Two records are thought to be indistinguishable in the event that they guide to a similar arrangement of shingles;1 they are thought to be comparative on the off chance that they guide to comparable arrangements of shingles. Quantitatively, the similitude of two documents is characterized to be the quantity of particular shingles showing up in the two archives partitioned by the aggregate number of unmistakable shingles. This implies two indistinguishable reports have likeness 1, while two archives that have no shingle in like manner have closeness 0.

Note that the estimation of k parameterizes how touchy this metric is Changing “kumquat” to “persimmon” in an n-word record (expecting that “kumquat” and “persimmon” happen no place else in the record) brings about a closeness of n k be- tween the first and the altered record. This implies one ought not pick k to be too vast, for fear that even little changes result in low comparability. Then again, neither should one pick k to be too little. As an outrageous case, setting k to 1 brings about an examination of the vocabulary of two reports, making the metric totally coldhearted to word requesting.

Our element vector extraction module substitutes HTML markup by whitespace, and after that sections the archive into 5-word shingles, where each word is a continuous arrangement of alphanumeric characters. Next, it registers a 64-bit checksum of each shingle, utilizing Rabin’s fingerprinting calculation [3, 10]. We call these fingerprints the “pre-pictures”. Next, the module applies 84 extraordinary (haphazardly chose however settled from there on) balanced functions to each pre-picture. For each capacity, we hold the pre-picture which brings about the numerically littlest picture. This outcomes in a vector of 84 pre-pictures, which is the coveted element vector.

In the event that the coordinated capacities are picked randomly,2 then given the component vectors of two reports, two relating components of the vectors are indistinguishable with likelihood equivalent to the similitude of the archives.

The component vector extraction module logs the element vector of each report, together with a checksum of its crude substance, the begin time and the span of its recovery, the HTTP status code (or a blunder code demonstrating a TCP mistake or a robot rejection), the document’s length, the quantity of non-markup words, and the URL. On the off chance that the archive can’t be downloaded effectively or does not bring about a HTML document,3 the module logs the URL and unique values for everything else. URLs that were not downloaded in light of the fact that the creep was ended before it was finished are dealt with in a comparative form.

The report inspecting module spares those effectively down-stacked archives whose URLs hash to 0 modulo 1000; as it were, it spares 0.1% of all downloaded records (expecting we utilized a uniform hash work). The log contains the URL of each archive and in addition the whole HTTP reaction to each demand, which incorporates the HTTP header and in addition the record.

Distilling the Data

Slithering left us with 44 substantial logs (created by the eleven creeps on the four crawlers), each spreading over numerous records, one every day. The logs totaled around 1,200 GB, while the tested documents took up a negligible 59 GB.

As they were, these logs were not appropriate for investigation yet, be-cause the URLs happened in non-deterministic request in each log. One approach to redress this is play out a consolidation kind of the logs in light of their URL, with a specific end goal to unite the different occurrences of every URL. Notwithstanding, performing such a consolidation sort on 1,200 GB of information is restrictively costly. To beat this issue, we bucketized every one of the logs, isolating its substance more than 1,000 pails, utilizing a similar URL-based hash work as in the record testing module. This progression delivered 44,000 containers (1,000 basins for every crawler per
creep). While this may seem to twofold the capacity necessity, we could process an individual every day log record, and after that move it to close line stockpiling. Because of the bucketization, every one of the events of a given URL show up in correcting pails crosswise over ages, and each basin is under 30 MB in measure. This enabled us to then play out a quick in-memory kind of each pail, utilizing the URL as the key, and supplanting the first can with an arranged one.

Toward the finish of this procedure, the comparing basins of every age all contained the very same arrangement of URLs, in arranged request.

At last, we consolidated the pails crosswise over slithers, and refined them simultaneously. We did as such by repeating on every one of the four machines over the 1,000 pail classes, perusing a record at any given moment from every one of the eleven relating cans, and composing a consolidated record to a refined basin. Each joined record contains the accompanying data:

- The URL.
- The start times of the eleven downloads.
- The duration of each download.
- The length of the document at each download.
- The number of non-markup words in the document at each download.

The HTTP status code (or error code) for each download. Six “super shingles” for each download. For each pair of downloads, an 84-bit vector indicating if the 84 corresponding pre-images matched. For each pair of downloads, a match count (see below).

Note that the refined record does exclude the checksums or the pre-pictures of each report. These qualities are subsumed by the “super shingles”, the bit-vectors, and the match tallies.

Every one of the six “super shingles” speaks to the connection of 14 nearby pre-pictures. Because of the autonomy of the balanced capacities used to choose pre-pictures, if two archives have comparative ity p, every one of their supershingles matches with likelihood p^14. For two reports that are 95% comparative, each supershingle matches its partner with likelihood 49%. Given that we hold six super-shingles, there is a likelihood of very nearly 90% that no less than two of the six supershingles will concur for reports that are at least 95% comparative. Holding the super shingles will be valuable later on, should we endeavor to find estimated mirrors [2] and examine their refresh recurrence.

The match check, when non-negative, demonstrates what number of the 84 pre-picture sets coordinated between the two reports. On the off chance that the record unique mark coordinates also, the match tally is set to 85. The match tally is negative if either archive was not down-stacked effectively or contained no words by any means (which caused the pre-pictures to have a default esteem); its esteem demonstrates which condition connected to which record, and whether the reports were indistinguishable (i.e. their checksums coordinated).

Mining the Data

While the first logs were 1,200 GB in measure, the refined buckets expend just around 222 GB. All things being equal, despite everything it takes around 10 hours to peruse the refined logs. Keeping in mind the end goal to direct the statistical tests we give an account of beneath (and also various others which demonstrated less useful), we expected to figure out how to lead each test extensively quicker. We accomplish this by running a few trials without a moment’s delay, in this way amortizing the cost of perusing the logs over numerous analyses.

Utilizing this approach, we were never again constrained by our computer’s capacity to peruse the logs, yet rather by our capacity to choose from the earlier which examinations would intrigue and pertinent. Given the experimentation character of any information mining movement, despite everything we needed to complete a few ignores the information to develop the majority of the tests depicted beneath.

We manufactured an analyzer saddle that peruses the refined buckets one record at any given moment, extends each record into a simple to-utilize configuration, and presents it to every one of an arrangement of analyzer modules. When the sum total of what containers have been perused, the outfit summons a “complete” strategy on every one of the analyzers, making them work out any total insights they may have accumulated. The analyzers and in addition the tackle are composed in Java; the bridle utilizes Java’s dynamic class stacking capacities to stack the analyzers at run-time.

Examples of the analyzers we wrote include:

- Status Code Analyzer, which produces a histogram of HTTP status codes and TCP error conditions.
Fetch Duration Analyzer, which produces the logarithmic histogram of document download durations.

Doc Length Analyzer, which produces the logarithmic histogram of document lengths.

Num Versions Analyzer, which produces a histogram of how many versions of each URL we managed to download successfully.

Top Level Domain Analyzer, which produces a histogram of top-level domains, and optionally counts the number of hosts in that domain.

Change Analyzer, which produces a histogram of the number of unchanged pre-images between two successive successful downloads of a URL.

Analyzers can be settled into larger amount analyzers. For example, it is conceivable to put a Change Analyzer into a Top Level Domain Analyzer, creating a rundown of report change histograms, one for each best level space. This is again executed utilizing Java’s dynamic class stacking apparatus. So as to keep the span of the yield sensible, we additionally give approaches to confine the quantity of best level areas considered (putting every single unspecified space into a catch-all class), to gather quantities of unaltered pre-pictures into bunches, and so forth.

For a portion of these larger amount analyzers, we have to total various qualities (for instance, the sizes of the eleven adaptations of a website page) into a solitary esteem, keeping in mind the end goal to choose what bring down level analyzer to conjure. We as of now give three distinctive approaches to total qualities, in particular least, most extreme, and normal. We intend to include bolster for mode, middle, and geometric normal.

Review that amid the information accumulation stage, we spared the full content of 0.1% of all effectively downloaded pages. We chose these pages in view of a hash of the URL, utilizing a similar hash work as the bucketizer. Specifically, we spared the full content of all pages that went into pail 0. This empowers us to utilize the analyzer outline work to identify intriguing examples, to utilize an extraordinary analyzer (utilizing more elevated amount analyzers around a “Dump URL Analyzer”) to get a run down of all URLs in can 0 that fit this example, and afterward to look at the full content of a portion of these reports.

We constructed some foundations to make this procedure simpler. In standard ticular, we prepend each record of examined reports with a list of URLs and archive balances, which enables us to recover any page in consistent time. Second, we actualized a web benefit that acknowledges a URL, a rendition number, and whether to restore the HTTP header or the report, and returns the asked for thing for show in the program. Third, we actualized another web benefit that acknowledges a rundown of examinations to run, executes them on a subset of the refined cans, and returns the outcomes as a page. We want to make these administrations, and additionally a portion of the refined basins, accessible to the examination group.

Results

The outcomes exhibited in this segment are gotten from breaking down the 151 million refined records in our gathering, utilizing the analyzer tackle and a considerable lot of the analyzers portrayed previously.

Figure 2 demonstrates a histogram of archive length, for the greater part of the 1,482,416,213 records that were effectively downloaded (i.e. that had a HTTP status code of 200), and in addition broken out by a couple of chosen top-level spaces. The x-hub signifies the report measure; an estimation of n implies that the extent of the record was beneath 2^n bytes, yet not underneath 2^n 1 bytes (an estimation of 0 shows that the archive had length 0).

The circulation we watched focuses at 14 with standard deviation 1; 66.3% of all watched HTML pages are between 4 KB and 32 KB long. Taking a gander at chose top-level spaces, pages in .com, which speak to 52.5% of every single watched page, to a great extent reflect the general dissemination, yet are one-sided marginally higher. Pages in organization and .gov, which represent 8.0% and 1.1% of every single watched page, individually, are like the general dissemination, yet are biased somewhat lower. Pages in .edu have a tendency to be littler, with 64.9% of the pages being between 2 KB and 16 KB.

Figure 3 is like Figure 2, however demonstrates a histogram of the quantity of words per record, rather than the quantity of bytes. Note that the conveyance of the .edu area is nearer to the general appropriation with regards to words, recommending that pages in .edu either have shorter words or less HTML markup.
Figures 4, 5, and 6 endeavor to catch diverse parts of the changelessness of website pages.

Figure 4 appears for each creep age the level of page recoveries bringing about various classes of status codes. The 200 classification (relating to the HTTP status code “200 OK”) demonstrates pages that were effectively downloaded. Note that the y-hub begins at 85%; in all ages, more than 85% of the recoveries were fruitful. The 3xx class contains every one of those pages that arrival a HTTP status code showing that the page has moved. Since all URLs in our set delivered a status code of 200 amid creep 1, the page has moved since. The 4xx classification contains all customer mistakes. The most well-known one is 404 (“Not Found”), demonstrating that the page has vanished without leaving a sending address, remotely took after by 403 (“Forbidden”). The other class contains all pages for which the web server restored a status code not recorded previously. The different 5xx return codes commanded; we likewise discovered numerous web servers returning status codes not recorded in the HTTP RFC. The system classification contains all recovery endeavors that flopped because of a system related mistake, for example, DNS query fall flat ure, declined associations, TCP timeouts, and so forth (take note of that Mercator influences five endeavors to determine a space to name, and three at-entices at recoveries that bomb because of TCP blunders). The Robot Excl classification contains every one of those pages that were obstructed by the web server’s robots. txt document, and that we along these lines avoided notwithstanding endeavoring to download. Once more, since these pages were not rejected amid slither 1, the prohibition was forced later. This seems, by all accounts, to be a type of the Heisenberg impact, where the presence of a spectator (a bothersome web crawler that jogs by consistently) changes the conduct of the watched.

As one may expect, Figure 4 substantiates that the lifetime of a URL isn’t boundless. As the creep ages increment, an ever increasing number of URLs move, wind up inaccessible, or are hindered from us. While one would expect a geometric movement of these patterns, we didn’t watch the web sufficiently long to recognize the pattern from a direct movement. The development of these three classifications comes to the detriment of the 200 class; variances in the offer of the system class seem better corresponded with arrange conditions at the crawler side.

Figure 5 indicates just the fruitful downloads as a level of all download endeavors (counting non-endeavors because of robot exclusion rules), separated
by a couple of chosen top-level spaces. Note that the y-pivot begins at 80%, mirroring the way that all areas in all ages had in any event that level of progress. By and large, pages in .jp, .de, and .edu were reliably more accessible than pages in .net and .com. The decrease in the bends confirms the constrained lifetime of site pages examined previously.

In Figure 6 we attempted another approach for survey the lifetime of URLs from various spaces. Each bar speaks to a best level area (the furthest left bar speaks to the whole informational collection). We gathered URLs by the creep age of their last fruitful recovery, the instinct being that a URL which couldn’t be downloaded after some point is probably going to have terminated. This approach allotments URLs into 11 sets. Each shaded locale of each bar speaks to the relative size of one such set. The locale at the highest point of a bar relates to URLs that were reliably inaccessible after creep 1 (the slither that characterized the arrangement of URLs), while the district at the base of a bar compares to URLs that were effectively downloaded amid the last creep. Note that the y-pivot, which demonstrates the rate breakdown of the aggregate, begins at 75%, because of the way that for all spaces considered here, over 75% of all URLs were as yet reachable amid the last creep. Taking a gander at the “all spaces” bar, it can be seen that 88% of all URLs were as yet accessible amid the last slither.

For most areas, the “alright at slither 10” districts are bigger than locales for going before creeps. This bodes well: it represents records that couldn’t be recovered amid the last creep, however may well return to life later on. Other than that, we see no detectable examples between the lengths of locales inside a bar.

Looking crosswise over areas, we watch that site pages in China terminate sooner than normal, as do pages in .com and .net.

The rest of the figures show data about the measure of progress in a record between two progressive effective down-loads. Figure 7 demonstrates a fine-grained outline of progress sum, autonomous of different elements. We parcel the arrangement of all sets of progressive effectively recovered pages into 85 subsets, in view of what number of pre-pictures the two archives in each match share. Sub-set 0 contains the sets with no basic pre-pictures, subset 84 the ones with all
basic pre-pictures, and subset 85 the ones that likewise concur in their report checksums (firmly proposing that the archives are indistinguishable as byte successors).

The x-pivot demonstrates the 85 subsets, and the y-hub indicates percent-ages. The lower bend (noticeable just at the outrageous left and right) depicts what level of all reports fall into a given subset. The bend above demonstrates the total rate dissemination. Each point (x; y) on the bend shows that y percent of all sets had at any rate x pre-pictures in like manner.

As can be seen (if your eyes are sufficiently sharp), 65.2% of all page sets don’t contrast by any stretch of the imagination. Another 9.2% contrast just in their registration, however have all basic pre-pictures (recommending that lone the HTML markup, which was expelled before registering pre-pictures, has changed).

Figure 8 amplifies the lower bend from Figure 7, making it simple to see that all other change pails contain under 2% of all page sets, and that all basins with less than 79 regular pre-pictures (speaking to report matches that are under 94% comparative) contain under 1%. Generally, the bend is monotonically de-wrinkling, yet this example is broken as we get to the pails containing records that experienced extraordinary change. Can 0, which speaks to finish uniqueness, represents 0.8%, more than ten times the level of can 7, the littlest basin.

We next attempted to decide whether there are any traits of a document that assistance to anticipate its rate and level of progress. In Figure 10, we look at the connection between top-level space and change. The figure demonstrates a bar for all page sets and a few more for chose spaces. Each bar is isolated into 6 locales, comparing to the accompanying six change bunches: finish change (0 regular pre-pictures), vast change (1-28 basic pre-pictures), medium change (29-56 basic pre-pictures), little change (57-83 basic pre-pictures), no content change (84 normal pre-pictures), and no change (subset 85: 84 basic pre-pictures and a typical checksum).

The best district delineates the entire change bunch, the one at the base the no change group. The y-hub demonstrates the rate.

We watch noteworthy contrasts between top-level areas, affirming prior perceptions by Cho and Garcia-Molina [5]. In the .com area, pages change more every now and again than in the .gov and .edu spaces.

So as to reveal insight into the issue, we swung to our examined reports, choosing records from Germany with high change rate. Watchful examination of the initial couple of pages uncovered more than we wanted to see: of the main about six pages we analyzed, all be that as it may, one contained disjoint, however flawlessly syntactic expressions of a grown-up nature together with a redirection to a grown-up site. It soon turned out to be certain that the expressions were naturally created on
the fly, to stuff web indexes, for example, Google with topical watchwords encompassed by sensible-looking setting, to attract guests to the grown-up site. Upon assist examination, we found that our informational collection contained 1.03 million URLs drawn from 116,654 hosts (4,745 of them being outside the .de area), which all made plans to a solitary IP address. This machine is serving up more than 15% of the .de URLs in our informational collection.

We estimate that the reason for utilizing that numerous particular host names as a front to a solitary server is to go around the good manners arrangements that farthest point the quantity of pages a web crawler will endeavor to download from any given host in a given time interim, and furthermore to trap interface based positioning calculations, for example, PageRank into believing that connects to different pages on obviously unique hosts are non-nepotistic, subsequently blowing up the positioning of the pages in the club.

After this revelation, we set out to investigate if there were other such servers in our informational collection. We settled the representative host names of the considerable number of URLs in our informational index, and singled out every IP address with in excess of a thousand emblematic host names mapping to it. There were 213 such IP addresses, 78 of which ended up being of a comparable sort as the site that set off our examination. We rejected all URLs on the 443,038 hosts that made plans to one of the 78 recognized IP addresses, and reran the examination that created Figure 10. This dispensed with around 60% of the over the top expansive and finish change in .de. The balanced conveyance is appeared in Figure 11. Proceeded with examination of the exorbitant change found that consequently generated obscene substance represents a significant part of the rest of.

In Figure 12, we take a gander at similar information, yet preclude all sets of documents with no change. Other than Germany (and to a lesser ex-tent China and Japan), there is amazingly little contrast between the different best level areas. Our decisions are twofold: First, erotic entertainment keeps on skewing our outcomes. Second, our shingling procedure isn’t all around adjusted to composing frameworks like Chinese or Kanji that don’t utilize between word separating, which thus makes archives have few shingles, which implies that any change is viewed as noteworthy.

Figure 9 is like Figure 8, however avoids similar URLs that were prohibited in Figures 11 and 12. Note that the majority of the non-monotonicity at the correct end of the appropriation has vanished, with the exception of container 0, which regardless has been sliced down the middle.

We next consider whether the length of pages impacts their rate of progress. In Figure 13, we utilize a similar x-pivot semantics as in Figure 2, and a similar y-hub semantics and reference chart encodings as in Figure 10. The most striking component of this figure is that record measure is emphatically identified with sum and rate of progress, and illogically so! One may imagine that little records will probably change, and in the event that they do, change all the more seriously (since any change is a huge change). Notwithstanding, we found that expansive archives (32 KB or more) change substantially more as often as possible than littler ones (4 KB and beneath).

Figure 14 is comparable in soul, yet looks at the relationship between the quantity of words and the rate of progress. As it were, this metric is more clear, since the affectability of our shingling strategies relies upon the quantity of words in an archive. For reports with few words, our metric gives a moderately coarse, “win big or bust” closeness metric. In any case, this figure echoes the
perception of Figure 13, that vast reports will probably change than littler ones.

In Figure 15, we look at a similar data, barring the archives with no change. We watch that pages with vary ent quantities of words display comparable change conduct, aside from that pages with only a couple of words can’t demonstrate a halfway measure of progress, because of our examining system.

We additionally researched whether there are any jumbling relationships between report size and best level space. Figure 16 utilizes an indistinguishable portrayal from Figure 13, however each graph considers just those URLs from a particular a the best level space. The distributions for the .com and .net spaces display a considerably more grounded edge impact for substantial reports than do .gov and .edu. Figure 17 looks at the relationship of progressive changes to an archive. The figure demonstrates a 3D histogram. The x hub means the quantity of pre-pictures in a report unaltered from week n 1 to n, the y hub the quantity of pre-pictures unaltered from week n to n + 1, and the z pivot demonstrates the logarithm (base 2) of the quantity of such records. An information point (x; y; z) demonstrates that there are 2z record/week sets (d; n) for which the renditions of archive d had x pre-pictures in like manner between weeks n 1 and n, and y pre-pictures in like manner between weeks n and n + 1.

The tower encompassing the (x; y) organize (85; 85) speaks to by far most of website pages that don’t change significantly finished a three-week interim. The tip of the tower is ten thousand times higher than some other component in the plot, with the exception of the litter tower at the opposite end of the askew, which speaks to records which vary totally in each example. A lot of this second pinnacle can be credited to machine-produced erotic entertainment, as portrayed previously.

The second-most noticeable component is the articulated edge along the principle slanting of the xy plane. The peak of the edge speaks to a thousand fold higher number of occurrences per network point than the floor of the valley. This edge proposes that progressions are very cor-related; past changes to a record are a magnificent indicator of future changes.

The crest at the most distant dividers of the plot show that a sizable portion of reports don’t change in a given week, regardless of whether they changed in the past or following week.

Figure 18 alters the past figure in two ways: The view is down the z pivot, changing the 3D plot into a 2D form delineate, shading/shading demonstrate the rise of the territory. In addition, as opposed to showing outright quantities of tests, we consider every segment as a likelihood circulation (implying that each datum point is separated by the whole of the information focuses in its section). Since these qualities run from 0 to 1, their logarithms are negative. This standardization wipes out the towers that were so noticeable in the past figure. The askew edge, be that as it may, remains, indicating by and by that past change is a solid indicator of future change. Similarly, the tuft along the best remains plainly unmistakable.
Conclusions

This paper portrays a vast scale try went for measuring the rate and level of website page changes over a huge period of time. We slithered 151 million pages once per week for eleven weeks, sparing remarkable data about each downloaded document, including a component vector of the content without markup, in addition to the full content of 0.1% of all downloaded pages. Along these lines, we refined the held information to make it more amiable to factual examination, and we played out various information mining activities on the refined information.

We found that site pages that change more often than not change just in their markup or in unimportant ways. In addition, we found that there is a solid connection between the best level space and the recurrence of progress of a record, though the connection between top-level area and level of progress is substantially weaker.

To our extraordinary astonishment, we found that archive measure is another solid indicator of both recurrence and level of progress. More-more than, one may anticipate that that any change will a little record would be a noteworthy one, by ethicalness of little reports having less words, with the goal that any word change influences a huge division of the shingles. In opposition to that instinct, we found that substantial records change more frequently and more broadly than littler ones.

We explored whether the two variables – top-level area and report measure – were perplexing, and found that generally, the relationship of archive size and rate and level of progress are more articulated for the .com and .net spaces than for, say, the .edu and .gov areas,
proposing that they are not bewildered. We additionally found that past changes to a page are a decent indicator of future changes. This outcome has down to earth suggestions for incremental web crawlers that try to expand the freshness of a page accumulation or list.

We have done some constrained examinations with the inspected full content reports to research a portion of our all the more bewildering outcomes. These trials helped us in revealing a wellspring of contamination in our informational index, in particular machine-produced pages developed to spam web search tools. We trust that future work using the examined full content records will furnish us with extra bits of knowledge.

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**References**

Security Health monitoring and Attestation of Virtual Machines in Cloud computing

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Abstract

Cloud customers need guarantees regarding the security of their virtual machines (VMs), operating within an Infrastructure as a Service (IaaS) cloud system. This is complicated by the customer not knowing where his VM is executing, and on the semantic gap between what the customer wants to know versus what can be measured in the cloud. We present architecture for monitoring a VM’s security health, with the ability to attest this to the customer in an unforgivable manner. We show a concrete implementation of property based attestation and a full prototype based on the OpenStack open source cloud software.

Key words: cloud computing, IAAS, virtual machine, security health, infrastructure, attestation

Introduction

Cloud customers are concerned about the security of the virtual machines (VMs) they lease. Recently, researchers have suggested a “security on demand” service model for cloud computing, where secure computing platforms are dynamically provisioned to cloud customers according to their specific security needs [24]. This also enables cloud providers to deploy new secure servers, which may have different security features that customers want, while still running unsecured virtual machines on their existing machines. The availability of secure computing platforms is a necessary but not a sufficient solution to convince cloud customers to move their sensitive data and code to the cloud. Cloud customers need further assurance to convince the VM that the security measures are indeed deployed, and are working correctly. In this paper we present an end-to-end architecture for both monitoring and attestation of a VM’s security properties in an IaaS cloud. IAAS cloud is a customer requests to launch a VM in the cloud system. The cloud provider places the VM in a virtualized cloud server, and allocates a specified amount to physical resources (CPU, memory, disk, etc.) To this VM. The customer is granted remote access to this VM. During the VM’s life-time, the customer would like to know if his VM has well. Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage, and that copies bear this notice and the full citation on the first page. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org. Security health.

A healthy VM satisfies the security properties for customer requested for his leased VM. For example, if the customer stores sensitive data in the cloud server’s storage, a healthy VM enforces confidentiality protection of the data from other VMs, or from physical attackers. For another customer with time-critical service needs, a healthy VM means that resources have been contracted for in the Service Level Agreement (SLA) are always available to the VM.

In cloud computing, different customers share the same cloud server, as co-tenants or co-resident VMs. These VMs may be long to competitors, spies, or malicious attackers. The security heath of a VM should take into account the other co-resident VMs, not just the attacks from within his VM (e.g., malware, guest OS root kits, etc.). We call this outside-VM and inside-VM vulnerabilities, respectively. Past work have shown that the “bad neighbor” VMs are able to steal critical information through side-channel attacks thus...
compromising the VM’s confidentiality health. Resource contentions between different VMs on the same server motivate malicious VMs to perform the Resource-Freeing Attack, thus compromising the victim VM’s availability health. Large cloud management software, including the hypervisor, will also have bugs [29]. Hence, a VM’s security health depends on not only the activities inside the VM, but also the VM’s interactions with the environment. Monitoring the VMs’ security health poses a series of challenges in a cloud system. First, the customer’s limited privileges prevent him from collecting comprehensive security measurements to monitor his VM’s health securely. He only has access to the VM, but not to the host server.

For inside VM vulnerabilities, once the VM’s OS is compromised by the attacker, the customer may not get correct measurements. For outside-VM vulnerabilities, the customer cannot collect information about the co-resident VMs, hypervisor, etc. Second, the customer’s desired security requirements are expressed in terms of a VM, but the security measurements usually involve the physical server, the hypervisor and other entities related to this VM. This creates a semantic gap between what the customers want to monitor and the type of measurements that can be collected. Third, the VMs go through different lifecycle stages and may migrate to different host servers. A seamless monitoring mechanism throughout the VMs’ lifetime is therefore highly desirable. Fourth, there are numerous entities between the customers and the point of VM operations.

In this paper we design a flexible architecture called CloudMonatt, to monitor the security health of customers’ VMs with in a cloud system. CloudMonatt is built upon the property-based attestation model, and provides several novel features. First, it provides a framework form on intoning different aspects of security health. Second, it shows how to interpret and map actual measurements collected to security properties that can be understood by the customer. These bridge the semantic gap between requested VM properties and the platform measurements for security health. Third, to the best of our knowledge, this is the first concrete realization of property-based attestation for a VM. Previous work discusses the desirability of property-based attestation, versus binary attestation, but did not give any implementations. Fourth, attestations can be done at runtime and for VM migrations, not just at boot up and VM launch time. Fifth, CloudMonatt provides remediation response strategies based on the monitored results.

Key contributions in this paper are:

- Definition of “security health” of a VM for several different security properties.
- Design of a flexible architecture to monitor the security health of VMs on cloud servers over the VMs’ lifecycle. Concrete examples to show how to bridge the semantic gap between security properties and measurements.
- Providing automatic remediation responses to failing security health indicated by negative attestation results.
- Full prototype the architecture with property-based attestation in a cloud infrastructure.

Section 2 reviews the background and related work. Section 3 describes the CloudMonatt architecture and its essential monitoring and attestation protocols. Section 4 gives concrete examples of security property measurements and their interpretation. Section 5 shows the security monitoring at different VM stages, and the corresponding remediation response strategies. Section 6 gives the details of our prototype implementation. Section 7 shows the performance and security evaluations. We conclude in Section 8.

Background and Related Work

Different techniques have been proposed for security monitoring and attestation of VMs. We describe some past work in Virtual Machine Introspection (VMI) and Remote Attestation.

Virtual Machine Introspection

Past work on inside-VM threats proposed Virtual Machine Introspection techniques. This can provide the service of VM health monitoring at the hypervisor level. Since the hypervisor monitor is outside the VM, it is able to detect the existence of malicious entities inside the VM, while being isolated, and thus protected, from the VM of malicious or untrusted entities inside the VM, while being isolated, and thus protected, from the VM. Since the introduction of the VMI technique and the Livewire intrusion detection system [19], much VMI-based architecture have been designed to
monitor the inside-VM health, e.g., VMwatche, Ether, Lares, virtuoso, VMST, etc. These architectures detect abnormal behaviors inside the VM, but don’t consider the threats from co-resident VMs or other outside-VM entities. For instance, a VMI tool may be able to detect confidentiality breaches caused by malicious programs residing in the target VM, but it cannot detecting formation leakage via cross-VM side channels (as we do, in a concrete example in Section 4). Also, how to use these techniques in the cloud system and allow the remote customer to use these monitoring services are problems which have not been addressed. We address these problems and show how VMI technologies can be seamlessly deployed in our CloudMon architecture.

Remote Attestation

Remote attestation has been defined to enable remote customers to test the integrity of a targeted system based on the integrity hash measurements supplied by that system. TPM-based attestation, proposed by the Trusted Computing Group (TCG), can verify the platform integrity of a remote server. The targeted server uses the Trusted Platform Module (TPM) to calculate the binary hash values of the platform configurations and send them to the customer. The customer compares these values with reference configurations, possibly via a trusted third party appraiser, and determines whether the state of the platform is in the unmodified (good) state. Many systems enabled with remote binary attestation have been designed (e.g., Intel’s TXT, IMA, PRIMA, BIND [38], Pioneer TVMM [18], etc.). In the context of virtualization platforms, the virtual Trusted Platform Module (TPM) was designed to provide the same usage model and services to the VMs as the hardware TPM. Then, remote attestation can be carried out directly between the customers and their virtual machines by the VTPM instances. VTPM based attestation raises some problems for VM monitoring: it cannot monitor the security conditions of the VM’s environment. Furthermore, the monitoring tool resides in the guest OS, so it needs modification of the guest OS, and commodity OS are also highly susceptible to attacks. To overcome the above problems, the concept of centralized attestation is introduced in the cloud system to manage the attestation procedure. In [36], Schiffman et al. implemented a centralized “cloud verifier” that can provide the integrity attestations for customers’ VM applications. Customers issue the authorization further VM to access applications only when the integrity attestation passes. In [34], Santos et al. designed a centralized monitor to check the platform’s configurations and map them to security attributes. This enables customers’

Figure 3: Implementation of Attestation Architecture.

Attestation Server

The attestation server and client are realized by OpenAttestation. Three of the four main modules remain unchanged: oat database stores information about the cloud servers and measurements; oat appraiser is responsible for triggering attestations and reporting the measurements; oat PrivacyCA provides public-key certificates for the cloud servers. We modify oat API by extending the APIs with more parameters, i.e., security properties and VM id. We add a new module oat interpreter: this essential new module implements the Property Interpretation and Certification Modules of the Attestation Server. It can interpret the security health of the VM and make attestation decisions, based on the information of the cloud server from the nova database and the security measurements from the oat database.
Cloud Servers

In each cloud server, nova compute is the client side of OpenStack nova. We modify oat client, the client side of OpenAttestation, to receive attestation requests. We modify the TPM emulator to provide secure storage and crypto functions. We add two new modules: Monitor Kernel can start the security measurements and store the values into the TPM emulator, and Monitor tools can integrate different software VMI tools, VMM Profile tools or other logging or provenance tools, into the server to perform the monitoring and take measurements.

Security verification

We conduct a security verification of CloudMonatt. We aim to address two questions: (1) can CloudMonatt provide unforgivable VM health reports to customers and the cloud provider? (2) What are the minimal security requirements (i.e., software/hardware modules that need to be trusted) that can guarantee the security and correctness of CloudMonatt?

Verification Methodology

To verify a system’s protocols we first specify the verification goals and invariants based on the systems functionality then we build models for the system, identify the trusted and untrusted subjects in the system. We implement the models and verification invariants in a cryptography verification tool and run this tool to test if the invariants pass for every possible path through the system models from the initial state to the end state, If an invariant fails cases, we try to find the vulnerabilities and construct the corresponding attacks. We describe these steps for verifying CloudMonatt in detail below.

Analyzing verification goals. CloudMonatt has two basic functionalities: (1) reporting VMs’ potential security threats to the cloud provider so it can take the corresponding countermeasure to mitigate the threats; (2) notifying the customers of their VMs’ security health. So CloudMonatt must ensure that the cloud provider and customers can receive the correct and unforgivable monitoring reports. These are the two verification goals of CloudMonatt. Figure 4 shows the structure of verification goals and their dependent conditions. The two red blocks (at the top and left) show the two main goals we want to verify: (1) the goal that the customers can receive the correct reports depends on three conditions: the Cloud Controller can receive the correct reports, process them correctly and transmit them securely to the customers. (2) The goal that the Cloud Controller can receive the correct reports also depends on three conditions: the Attestation Server can receive the correct measurements, process them (i.e., generate correct reports) correctly, and transmit the reports to the Cloud Controller securely. In addition to the above two main goals, the condition that the Attestation Server can receive the correct measurements depends on two conditions: the cloud server collects correct measurements, and such measurements can be transmitted to the Attestation Server securely. The trustworthiness of each server depends on two conditions: the critical software and hardware modules function correctly, and messages are exchanged securely between these modules.

In order to verify the main goals in a scalable way, we break the verification task into two steps, adapting and extending the methodology from [7]. The first step is external verification, which aims to verify the main verification goals. In this step, we treat each server as a black box For each server we only consider the black block as a precondition and assume it is already satisfied, while ignoring other basic preconditions (grey blocks) inside the boxes. Under such preconditions and other basic preconditions outside of the black boxes, we verify if the main goals are held. The second step is internal verification in which we consider the activities inside each server. In this step, the precondition we assume in the previous step becomes the post condition that we want to verify. We want to check if such post condition is held, i.e., the precondition we make in the previous step is correct, under the basic preconditions inside the dashed box.

Modeling systems. To verify the above goals of CloudMonatt, we need to translate the system protocols and the underlying architecture in to representative yet tractable models system protocols and the underlying We adopt the symbolic modeling method [51], where the crypto graphic primitives are represented by function symbols and perfect cryptography is assumed. Specifically, we first specify subjects involved in this verification procedure. A subject can be a customer or a server in the distributed system, or a hardware/software module inside a server. For external verification, since we treat each server as a black box, we model each server and the customer as a subject. For internal verification, we need to consider the internal activities inside the
server, so we model each software and hardware module involved in the system operation as a subject. Each subject has a set of states with inputs and outputs based on the system operation. The transitions between different states are also defined by the architecture designs and protocols. Among all the subjects, there is an initiator subject that starts the system protocol and a finisher subject that ends the protocol. This initiator subject has a “Start” state while the finisher subject has a “Done” state. The verification procedure starts at the initiator’s “Start” state. At each state in each subject, it takes actions corresponding to the transition rules. It will exhaustively explore all possible rules and a state to find all the possible paths from the initiator’s “Start” state to the finisher’s “Done” state. Then we judge if the verification goals are satisfied in all of these paths. The system is verified to be secure if there are paths from initiator’s “Start” state to finisher’s “Done” state, and all the verification goals are satisfied in any of these paths.

**Specifying security invariants.** Invariants are conditions that need to hold true for there to be no violation of the verification goals or post conditions. The invariants can be specified from the goals or post conditions that we want to verify. For CloudMonatt, the goals of external verification are to ensure the customer and the Cloud Controller receives the correct reports. So the invariants are that the reports received by the customer and the Cloud Controller are always the ones matching the security property and VM id they specify. The post conditions for internal verification are to ensure that the servers process the data correctly. so the invariants are that the output sent from the server are always the ones correctly mapped to the input sent to the server.

**Identifying preconditions.** Preconditions refer to the basic requirements that are needed to keep the security invariants true within the system protocols or operations. Basically it specifies the necessary subjects that should be trusted. For external verification, the preconditions are the assumptions we make about each server. For internal verification, the preconditions are the subjects that should be included in the Trusted Computing Base. The verification results can help us identify the minimal TCB for CloudMonatt, the necessary and critical software/hardware modules or servers that should be well protected to guarantee the correctness of CloudMonatt. In the next two sections, we conduct the external verification and internal verification separately.

We use ProVerif to model the system and verify the security invariants. ProVerif is a software tool for checking security properties in cryptographic protocols. It supports a variety of cryptographic primitives, e.g., symmetric and asymmetric cryptography, digital signatures, hash functions, etc. If a security property is proven unsatisfied, ProVerif can reconstruct the attacker execution trace that falsifies the property. We show how to use ProVerif to check the system interactions, in addition to network protocols.

**External Verification**

**Modeling:** We model each server involved in this distributed system as an interacting state machine. Each subject is made up of some states. The whole process starts from the customer side, which sends to the Cloud Controller the attestation request including the VM identifier $Vid$ and the desired security properties $P$. Forwards the request to the Attestation Server, with the server identifier $I$. The Attestation Server identifies the necessary monitoring measurements and sends the measurement request $RM$ to the host cloud server. The cloud server collects the required measurements, calculates the hash value, $Q$, of the measurements requested and then sends these values back to the Attestation Server, after which the cloud server reaches the “Done” state. The Attestation Server checks the signature, the hash value and the nonce: if this check fails, the Attestation Server goes to “Abort” state. Otherwise it interprets the measurements and the property, and generates the attestation report $R$, as explained in Section 3.4. Then the Attestation Server signs the report, transmits it to the Cloud Controller, and goes to state “Done”. After receiving the report, the Cloud Controller checks the signature, the hash value and the nonce. If anything is incorrect, the Cloud Controller goes to state “Abort”. Otherwise it hashes and signs the report, and ends at state “Done” after sending the report to the customer. If the customer finds the encrypted signature of the report is correct; it goes to state “Done”. Otherwise, it goes to state “Abort”.

**Security invariants:** As we discussed in Section 5.1, the external verification is to check if the customer and cloud provider can receive the correct attestation reports. We identify several specific security invariants for this task in our modeled state machines:

The Cloud Controller is able to reach state “Done”.

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When it is at state “Done”, the attestation report $R$ it receives is indeed the one for VM $V_{id}$ with property $P$, specified by the customer.

The customer is able to reach state “Done”. When he is at state “Done”, the attestation report $R$ he receives is indeed the one for VM $V_{id}$ with property $P$, specified by the customer.

Invariant 1 is to ensure the cloud controller gets the correct attestation reports. Invariant 2 is to ensure the customer gets the correct attestation reports.

**Preconditions:** We make several preconditions about each server and check if the above security invariants can be satisfied under these preconditions. These preconditions indicate the subjects that should be included in the TCB. Verifying the sufficiency and necessity of these preconditions can help us find the minimal TCB for CloudMonatt.

1. The cloud service is trusted.
2. The attestation server is trusted.
3. The cloud controller is trusted.

Here a “trusted” server means it will strictly follow the operations indicated in our protocol. For instance, a trusted cloud server will collect and sign correct measurements; a trusted Attestation Server will process the measurements and generate the reports correctly; a trusted Cloud Controller will process the VM health reports correctly. In addition, a trusted server will keep its secrets from attackers.

**Implementation** We model the authentication and communication protocols of external verification in ProVerif. Specifically, we declare each subject as a process. Each process keeps some secrets. If the subject is trusted, then the attacker cannot get these secrets, and we use the keyword private to denote these variables. Otherwise the variables are declared as public and the attacker can obtain the values.

**Security invariants.** As we discussed in Section 5.1, the external verification is to check if the customer and cloud provider can receive the correct attestation reports. We identify several specific security invariants for this task in our modeled state machines:

The Cloud Controller is able to reach state “Done”. When it is at state “Done”, the attestation report $R$ it receives is indeed the one for VM $V_{id}$ with property $P$, specified by the customer.
The customer is able to reach state “Done”. When he is at state “Done”, the attestation report R he receives is indeed the one for VM Vid with property P, specified by the customer.

Invariant 1 is to ensure the Cloud Controller gets the correct attestation reports. Invariant 2 is to ensure the customer gets the correct attestation reports.

Preconditions. We make several preconditions about each server and check if the above security invariants can be satisfied under these preconditions. These preconditions indicate the subjects that should be included in the TCB. Verifying the sufficiency and necessity of these preconditions can help us find the minimal TCB for CloudMonatt.

(C1) The cloud server is trusted.
(C2) The Attestation Server is trusted.
(C3) The Cloud Controller is trusted

Here a “trusted” server means it will strictly follow the operations indicated in our protocol. For instance, a trusted cloud server will collect and sign correct measurements; a trusted Attestation Server will process the measurements and generate the reports correctly; a trusted Cloud Controller will process the VM health reports correctly. In addition, a trusted server will keep its secrets from attackers.

Implementation: We model the authentication and communication protocols of external verification in ProVerif. Specifically, we declare each subject (the customer, the Cloud Controller, the Attestation Server and the cloud server) as a process. Each process keeps some secrets. If the subject is trusted, then the attacker cannot get these secrets, and we use the keyword private to denote these variables. Otherwise the variables are declared as public and the attacker can obtain the values. To model the network activities in this system, we declare a channel between each pair of subjects, to represent the untrusted communication channel.

These channels are under full control of the network-level adversaries, who can eavesdrop or modify messages transmitted in the channels. We also use the cryptographic primitives from ProVerif to model the public key infrastructure for digital certificate, authentication and key exchange. ProVerif can check if the adversary can compromise the integrity of the report in any attestation session, and display the attack execution trace if vulnerability is found. We can use ProVerif’s reachability proof functionality to verify if the Cloud Controller and customer are each able to reach state “Done”. ProVerif allows us to define an event E inside a process at one state, which specifies some conditions. Then we can check if this event will happen when the protocol proceeds using the query statement: “query event (E)”. ProVerif can enumerate all the possible execution traces and check if this event is reachable in some cases. If so, this query statement returns true as well as the trace that reaches the event. Otherwise the statement returns false. So we can use the statement “query event (Done)” to check if the customer and Cloud Controller can receive the report. ProVerif does not provide direct functionalities to prove integrity. However, we can also use its reachability proof functionality to verify the integrity property of a message. Specifically, to verify the integrity of the attestation report in invariant 1, we check if the report received by the Cloud Controller, R’, is the correct one, R, determined by the VM identifier Vid.

Fig. 6: The external protocol in CloudMonatt. Kx, Ky and Kz are symmetric keys between the customer and the Cloud Controller, between the Cloud Controller and the Attestation Server, and between the Attestation Server and the cloud server, respectively. SKc, SKa and ASKs are the private signing keys of the Cloud Controller, the Attestation Server and the cloud server, respectively. N1, N2 and N3 are the nonces used by the customer, the Cloud Controller and the Attestation Server, respectively

The security property P and the VM’s state measurement M, when the Cloud Controller reaches state “Done”. Then we establish an event: "(R’6=)R" at state “Done” to denote the integrity breach. We use the statement “query some secrets (e.g., cryptographic keys, attestation reports or measurements). If the subject is trusted, then the attacker cannot get these secrets, and we use the keyword private to denote these variables. Otherwise the variables are declared as public and the attacker can obtain the values.

To model the network activities in this system, we declare a channel between each pair of subjects, to
represent the untrusted communication channel. These channels are under full control of the network-level adversaries, who can eavesdrop or modify messages transmitted in the channels.

We also use the cryptographic primitives from ProVerif to model the public key infrastructure for digital certificate, authentication and key exchange. Then we model all the steps for an unbounded number of attestation sessions, i.e., the customer keeps sending attestation requests to the cloud system and receiving the reports. ProVerif can check if the adversary can compromise the integrity of the report in any attestation session, and display the attack execution trace if vulnerability is found.

We can use ProVerif’s reachability proof functionality to verify if the Cloud Controller and customer are each able to reach state “Done”. ProVerif allows us to define an event \(E\) inside a process at one state, which specifies some conditions. Then we can check if this event will happen when the protocol proceeds using the query statement: “query event \(E\)”. ProVerif can enumerate all the possible execution traces and check if this event is reachable in some cases. If so, this query statement returns true as well as the trace that reaches the event. Otherwise the statement returns false.

So we can use the statement “query event (Done)” to check if the customer and Cloud Controller can receive the report. ProVerif does not provide direct functionalities to prove integrity. However, we can also use its reachability proof functionality to verify the integrity property of a message. Specifically, to verify the integrity of the attestation report in invariant 1, we check if the report received by the Cloud Controller, \(R'\) is the correct one, \(R\), determined by the VM identifier \(Vid\), the security property \(P\) and the VM’s state measurement \(M\), when the Cloud Controller reaches state “Done”. Then we establish an event: “\((R'6=1)\)R at state “Done” to denote the integrity breach. We use the statement “query event(R'6+)+R to verify the integrity. If this statement is false, it means the attacker has no means to change the message \(R\) without being observed by the Cloud Controller. Then the integrity of \(R\) holds. Similarly, to verify invariant 2, we check if the report \(R'\) received by the customer at state “Done”, is the correct one \(R\), by checking if the statement “\((R'6=\overline{R})\)” at state “Done “is false.

**Results.** ProVerif shows that state “Done” is reachable for both the Customer and Cloud Controller. Then we verify if the security invariants 1 and 2 are satisfied under the preconditions (C1) – (C3). First, ProVerif confirms that preconditions (C1) – (C3) are sufficient to guarantee that the customer and the Cloud Controller can receive the correct attestation reports. Note that as we put trust on the Cloud Controller, the Attestation Server and the cloud server, we do not need to consider the server-level adversaries. Even though the network-level adversaries can take control of all the network channels between each server, they cannot compromise the integrity of the messages without being observed, since all the messages are hashed, signed and encrypted before being sent to the network.

Second, we check if preconditions (C1) – (C3) are necessary to keep the invariants correct. ProVerif shows that it is necessary to place the subjects of (C1), (C2) and (C3) in the TCB. Missing any precondition can lead to violations of some invariants: if the cloud server is not trusted, then the server-level adversary can counterfeit wrong measurements, causing the Attestation Server to make wrong attestation decisions, and pass them to the Cloud Controller and the customer. So invariants 1 and 2 are not satisfied. If the Attestation Server is not trusted, then it can generate wrong attestation reports for the customer and the Cloud Controller. So invariants 1 and 2 are not satisfied. If the Cloud Controller is untrusted, it can modify the reports before sending to the customer. So invariant 2 is not satisfied. In the next section, we perform internal verification of the trusted servers, to show which component in each of the servers should be trusted, in order to satisfy the preconditions we assume in this section.

**Internal Verification**

From Section 5.2 we know that to satisfy the external verification goals, we need to assume the correctness of the preconditions in each server, i.e., trusting the data processing in the Cloud Controller, the Attestation Server and the cloud server. However, we do not need to place the entire server into the TCB. On the one hand, trusting each component in one server is not a necessary condition to satisfy the precondition we assume for this server. Also, including all the components of the server into the TCB would require stronger security protection for the entire server, which is expensive and difficult to achieve. On the other hand, it is impossible to trust every
component in the server, especially for the cloud server which hosts the guest VMs rented to the customers. CloudMonatt cannot ensure that the guest VMs are trusted. As such, we conduct the internal verification to identify which components inside the server need to be trusted, to satisfy the preconditions in the external verification.

The necessity and sufficiency of these preconditions for guaranteeing the integrity of measurements taken from the cloud server.

1. Attestation Client:
   (C1.1) this module is trusted.

2. Monitor Module:
   (C2.1) The Monitor Kernel is trusted.
   (C2.2) The Monitor Tools are trusted.
   (C2.3) The channel between the Monitor Kernel and the Monitor Tools is trusted.

3. Trust Module:
   (C3.1) The Crypto Engine is trusted.
   (C3.2) The Trust Evidence Registers are trusted.
   (C3.3) The Attestation Key is securely stored.

Conclusion

CloudMonatt is an architecture that enables secure monitoring and attestation of security features provided by a cloud server for the customer’s VMs. We first describe the design of CloudMonatt and show its key advances over prior work:

(1) it is flexible and provides a rich set of security properties for VM attestation; (2) it bridges the semantic gap between the security properties a customer wants to request and the measurements collected from a cloud server; (3) it enables initialization as well as runtime attestation during the lifetime of the VM; (4) it defines a novel periodic attestation capability during VM runtime; (5) it provides automated responses to bad attestation results to prevent potential, or further, security breaches; it is protected by secure attestation protocols with a set of cryptographic keys that must be present or established; and (7) it is readily deployable. We leverage existing cloud mechanisms and well-honed security mechanisms where possible, identifying the minimal changes needed for a cloud system to implement our CloudMonatt architecture on the OpenStack cloud software.

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References

Country Location Classification on Tweets

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Abstract

The expansion of enthusiasm for utilizing online networking as a hotspot for explore has roused handling the test of naturally geolocating tweets, given the absence of express area data in the lion’s share of tweets. As opposed to much past work that has concentrated on area characterization of tweets confined to a particular nation, here we attempt the assignment in a more extensive setting by ordering worldwide tweets at the nation level, which is so far unexplored in a constant situation. We break down the degree to which a tweet’s nation of cause can be controlled by making utilization of eight tweet-innate highlights for grouping. Moreover, we utilize two datasets, gathered a year separated from each other, to examine the degree to which a model prepared from authentic tweets can at present be utilized for grouping of new tweets. With order probes every one of the 217 nations in our datasets, and on the main 25 nations, we offer a few experiences into the best utilization of tweet-intrinsic highlights for a precise nation level characterization of tweets. We find that the utilization of a solitary component, for example, the utilization of tweet content alone – the most generally utilized element in past work – fails to impress anyone. Picking a suitable mix of both tweet substance and metadata can really prompt significant enhancements of in the vicinity of 20% and half. We watch that tweet content, the client’s self-announced area and the client’s genuine name, which are all innate in a tweet and accessible in a continuous situation, are especially valuable to decide the nation of source. We additionally probe the appropriateness of a model prepared on authentic tweets to group new tweets, finding that the decision of a specific blend of highlights whose utility does not blur after some time can really prompt practically identical execution, evading the need to retrain. Be that as it may, the trouble of accomplishing exact order increments somewhat for nations with numerous shared characteristics, particularly for English and Spanish talking nations.

Key words: Characterization, Constant geolocation, Micro blogging, Twitter.

Introduction

Online networking are progressively being utilized as a part of mainstream researchers as a key wellspring of information to help comprehend diverse regular and social marvels, and this has provoked the improvement of an extensive variety of computational information mining instruments that can extricate learning from web-based social networking for both post-hoc and continuous examination. On account of the accessibility of an open API that empowers the sans cost collection of a lot of information, Twitter has turned into a main information hotspot for such examinations [53]. Having Twitter as another sort of information source, analysts have investigated the improvement of devices for constant pattern examination or early location of newsworthy occasions and additionally into systematic methodologies for understanding the supposition communicated by clients towards an objective or general assessment on a particular point. Nonetheless, Twitter information needs solid statistic points of interest that would empower a delegate test of clients to be gathered as well as an attention on a particular client subgroup [36], or other particular applications, for example, setting up the reliability of data posted [34]. Robotized induction of online networking socioeconomics would be valuable, among others, to expand demographically mindful web-based social networking investigations that are led through studies [16]. One of the missing statistic subtle elements is a client’s nation of source, which
we contemplate here. The main alternative then for the specialist is to attempt together such statistic qualities before endeavoring the expected examination.

This has roused a developing group of research lately taking a gander at various methods for deciding automatically the client’s nation of cause and additionally – as an intermediary for the previous – the area from which tweets have been posted \([1]\). The greater part of the past research in gathering tweet geolocation has ordered tweets by area inside a limited land region or nation; these can’t be connected specifically to an unfiltered stream where tweets from any area or nation will be watched. The few cases that have managed a worldwide accumulation of tweets have utilized a broad arrangement of highlights that can’t reasonably be separated in a continuous, spilling setting (e.g., client tweeting history or informal communities) \([14]\), and have been constrained to a chosen set of worldwide urban communities and additionally to English tweets. This implies they utilize ground truth marks to pre-channel tweets starting from different districts as well as written in dialects other than English. The classifier based on this pre-separated dataset may not be appropriate to a Twitter stream where each tweet should be geolocated. A capacity to order tweets by area progressively is essential for applications misusing online networking refreshes as social sensors that empower following themes and finding out about area particular inclining subjects, rising occasions and breaking news. Particular utilisations of a continuous, nation level tweet geolocation framework incorporate nation particular inclining subject identification or following sentiment towards a theme separated by nation. To the best of our insight, our work is the first to manage worldwide tweets in any dialect, utilizing just those highlights display inside the substance of a tweet and its related metadata. We likewise supplement past work by examining the degree to which a classifier prepared on recorded tweets can be utilized viably on recently reaped tweets.

Inspired by the need to build up an application to identify the slanting themes inside a particular country, here we record the advancement of a classifier that can geolocate tweets by nation of starting point progressively. Given that inside this situation it isn’t attainable to gather extra information to that promptly accessible from the Twitter stream \([14]\), we investigate the helpfulness of eight tweet-inalienable highlights, which are all promptly accessible from a tweet question as recovered from the Twitter API, for deciding its geolocation. We perform order utilizing every one of the highlights alone, yet additionally in include mixes. We investigate the capacity to play out the order on upwards of 217 nations, or in a lessened subset of the main 25 nations, as judged by tweet volume. The utilization of two datasets, gathered in October 2014 and October 2015, gives extra knowledge into whether recorded Twitter information can be utilized to arrange new occasions of tweets. These two datasets with more than 5 million nation coded tweets are openly accessible. Our technique empowers us to play out an exhaustive examination of tweet geolocation, uncovering experiences into the best methodologies for a precise nation level area classifier for tweets. We find that the utilization of a solitary component like substance, which is the most generally utilized element in past work, does not get the job done for an exact characterization of clients by nation and that the blend of various highlights prompts significant change, beating the cutting edge ongoing tweet geolocation classifier; this change is especially show when utilizing metadata like the client’s self-revealed area and also the client’s genuine name. We likewise play out a for every nation examination for the best 25 nations as far as tweet volume, investigating how extraordinary highlights prompt ideal characterization for various nations, and in addition talking about constraints when managing the absolute most difficult nations. We demonstrate that nation level grouping of an unfiltered Twitter stream is testing. It requires watchful outline of a classifier that uses a proper blend of highlights. Our outcomes at the nation level are sufficiently promising on account of numerous nations, empowering further research into better grained geolocation of worldwide tweets. Situations where nation level geolocation is all the more difficult incorporate English and Spanish talking nations, which are harder to recognize because of their various shared traits. In any case, our analyses demonstrate that we can accomplish F1 scores over 80% in a significant number of these cases given the decision of a fitting blend of highlights, and additionally a general execution over 80% as far as both miniaturized scale exactness and large scale precision for the best 25 nations.

**Related Work**

A developing assortment of research manages the computerized induction of statistic subtle elements of Twitter clients \([36]\). Re-searchers have endeavored to construe characteristics of Twitter clients, for example,
age sexual orientation, political introduction] or a scope of social personalities Delving all the more profoundly into the socioeconomics of Twitter clients, different scientists have endeavored to derive socioeconomic socioeconomics, for example, word related class, salary and financial status. Work by Huang et al. has additionally endeavored to construe the nationality of clients; this work is not the same as that which we report here in that the nation where the tweets were posted from, was at that point known.

What persuades the present examination is the expanding between est in inducing the land area of either tweets or Twitter clients [1]. The computerized derivation of tweet area has been contemplated for various purposes, running from information reporting to general wellbeing. And in addition numerous diverse procedures, analysts have depended on various settings and sought after various destinations when leading trials. Table1 shows a rundown of past work revealed in the logical writing, laying out the highlights that each examination used to characterize tweets by area, the geographic extent of the investigation, the dialects they managed, the order granuality they attempted to accomplish and utilized for assessment, and whether single tweets, collected numerous tweets as well as client history were utilized to prepare the classifier.

The vast majority of the past examinations on robotized geolocation of tweets have expected that the tweet stream incorporates just tweets from a particular nation. The larger parts of these examinations have concentrated on the United States, characterizing tweets either at a city or state level. One of the most punctual examinations is that by Cheng et al, who presented a probabilistic, content-based approach that distinguishes the most representative expressions of every one of the significant urban areas in the USA; these words are then used to order new tweets. They incorporate distinctive methods to channel words, for example, nearby and state-level sifting, grouping up to 51% of Twitter clients precisely inside a 100 mile span. Their approach, in any case, depends on making utilization of the entire history of a client, and was tried just for clients with no less than 1,000 tweets in their course of events.

A large portion of alternate investigations reported in the writing have additionally depended on tweet content, utilizing distinctive procedures, for example, subject demonstrating to discover locally important catchphrases that uncover a client’s probable area. Another broadly utilized procedure depends on the informal community that a client is associated with, so as to deduce a client’s area from that of their devotees and followers. While the methodologies abridged will function admirably for specific applications, recovering the tweet history for every client or the profile data of the greater part of a client’s adherents and followers isn’t plausible in a continuous situation. Subsequently, in this unique situation, a classifier needs to manage the extra test of relying just on the data that can be separated from a solitary tweet.

Just a modest bunch of studies have depended exclusively on the content of a solitary tweet to gather its area. Once more, the greater part of these have really taken a shot at exceptionally confined geological regions, with tweets being restricted to various districts, for example, the United States four distinct urban areas, and New York just. Bo et al. did center around a more extensive topographical region, including 3.7k urban communities everywhere throughout the world. In any case, their investigation concentrated on a predetermined number of urban communities, slighting different areas, and just characterized tweets written in English.

With regards to geolocation characterization granularity, the lion’s shares of studies have gone for city-level grouping. While this gives fine-grained arrangement of tweets, it likewise implies that a predetermined number of urban areas can be considered, overlooking different urban areas and towns. Just Han et al and Dredze et al perform nation level arrangement, in spite of the fact that they additionally confined themselves to English dialect tweets posted from a set number of urban communities. This implies tweets posted from urban areas other than the ones under thought are expelled from the stream, as are tweets composed in different dialects. In our examination, we take as info the surge of tweets with content starting from any nation and in any dialect, i.e. the whole tweet stream, to arrange, at the nation level, each tweet as indicated by its beginning.

To date, the work by Han et al. is the most important to our new investigation. They directed an extensive report on how Twitter clients can be geolocated by utilizing diverse highlights of tweets. They broke down how area demonstrative words from a client’s totaled tweets can be utilized to geolocate the client. In any case, this requires gathering a client’s history of tweets, which
isn’t practical in our continuous situation. They likewise took a gander at how some metadata from tweets can be utilized for grouping, accomplishing slight upgrades in execution, yet again this is for a client’s collected history. At long last, they took a gander at the transience of tweets, utilizing an old model to group new tweets, finding that new tweets are more hard to characterize. This is a clever investigation, which additionally spurs a portion of the settings and determination of classifiers in our own examination; in any case, while an approach in view of area characteristic words might be extremely helpful when taking a gander at a client’s amassed tweets, it is fairly restricted when – as for our situation – depending on a solitary tweet for each client. Rather, our examination of various tweet highlights for geolocating a tweet is construct exclusively in light of its qualities as recovered from the Twitter API. Dredze et al. [14] took an approach like our own when they took a gander at the utility of a model prepared from past tweets, finding that the order execution debases for new tweets and that the prepared model should be consistently refreshed. Their examination did not investigate additionally points of interest, for example, regardless of whether a few highlights are as yet helpful for new tweets, notwithstanding, and which our investigation examinations in more detail.

Datasets

For preparing our classifier, we depend on the most broadly received approach for the gathering of a Twitter dataset with tweets ordered by area. This includes utilizing the Twitter API endpoint that profits a surge of geolocated tweets posted from inside at least one indicated geographic jumping boxes2. In our investigation, we set this bouncing box to be the entire world (i.e., [-180, -90, 180, 90]) keeping in mind the end goal to recover tweets around the world. Along these lines, we gathered floods of worldwide geolocated tweets for two distinctive week long stretches: 4-11 October, 2014 (TC2014) and 22-28 October, 2015 (TC2015). This prompted the gathering of 31.7 million tweets in 2014 and 28.8 million tweets in 2015, which we adjust for our motivations as clarified beneath.

Our crude datasets mirror the verifiable truth that some Twitter clients are much more productive than others, which would present a predisposition in the assessment if not managed. In the event that our classifier has seen a client previously, it is likely that the client will tweet from a similar nation once more. Henceforth, keeping in mind the end goal to guarantee an unprejudiced assessment of the tweet level order, we de-copied clients from our datasets, by haphazardly picking just a single tweet from every client for TC2014. For TC2015, we likewise picked one tweet for every client aimlessly, yet in addition expelled clients that were incorporated into TC2014. This prompted an accumulation of 4,155,763 geolocated tweets in TC2014 and 897,341 geolocated tweets in TC2015. 462,536 tweets were expelled from the TC2015 dataset for having a place with clients that additionally showed up in TC2014.

Having these tweets geolocated with the particular coordinates of the client’s area, we at that point gathered the name of that area. For this, we utilized Nominatim3, whose switch geocoding highlight empowered us to recover nitty gritty information of the area indicated by the directions given as information. From Nominatim’s yield, we influenced utilization of the nation to code in our trials that went for nation level characterization of tweets. Accordingly, we had every one of the tweets in TC2014 and TC2015 ordered by nation, which we at that point utilized as the ground truth for our grouping tests. It is advantageous taking note of that the circulation of nations in TC2014 and TC2015 correspond very with r = 0.982. This recommends the conveyance is steady and accordingly we can concentrate our investigation on the handiness of the model prepared for various highlights for new tweets.

The in excess of 5 million tweets in these two datasets are arranged into 217 unique nations. It is advantageous saying that, as one would expect, the subsequent datasets are plainly imbalanced, where just a couple of nations represent the majority of the tweets. The main nation by number of tweets is the United States (20.99%), trailed by Indonesia (14.01%) and Turkey (8.50%). The 10 most noticeable countries on Twitter in our datasets represent 72.98% of the tweets, while the 25 most conspicuous
nations represent 90.22%. Figure 1 demonstrates a warmth guide of fame by nation in our datasets.

![Image](https://example.com/figure1.png)

**Fig. 1.** Prominence of countries in TC2014 and TC2015. Values in the legend represent percentages with respect to the entire dataset.

### COUNTRY-LEVEL LOCATION CLASSIFICATION FOR TWEETS

In this examination, we characterize the nation level area classification undertaking as one in which, given a solitary tweet as information, a classifier needs to decide the nation of root of the tweet. We contend for the sole utilization of the substance and metadata gave in a solitary tweet, which are open in a situation where one needs to characterize tweets by nation in the tweet stream and progressively. Most existing methodologies have taken a gander at the historical backdrop of a Twitter client or the informal community logical from a client’s supporters and followees, which would not be possible in our continuous situation. Arrangement Techniques.

We completed the experimentation with a scope of classifiers of various kinds: Support Vector Machines (SVM), Gaussian Naive Bayes, Multinomial Naive Bayes, Decision Trees, Random Forests and a Maximum Entropy classifier. They were tried in two distinct settings, one without balancing the weights of the diverse classes and the other by measuring the classes as the backwards of their recurrence in the preparation set; the last was tried as a methods for managing the very imbalanced information. The determination of these classifiers is in accordance with those utilized as a part of the writing, particularly with those tried by Han et al. [19]. This experimentation prompted the choice of the measured Maximum Entropy (MaxEnt) classifier as the most precise. In light of a legitimate concern for space and center, we just present outcomes for this classifier.

Also, we contrast our outcomes and two gauge approaches. From one perspective, we utilized the Vowpal Wab-bit classifier portrayed by [14], a cutting edge continuous tweet geolocation classifier. Then again, we made utilization of the GeoNames geological database, a generally utilized approach in the writing. The client area, a string alternatively determined by clients in their profile settings, can be utilized here as contribution to the GeoNames database, which will restore a probable area interpreted from that string. GeoNames gives a rundown of the in all likelihood areas for a given string, in view of either pertinence or populace, from which we took the main component. While GeoNames can be extremely compelling for certain area names that are anything but difficult to outline, utilization of this element is constrained to clients who select to indicate a non-discharge area string in their settings (67.1% in our datasets), and will fall flat with clients whose area isn’t a substantial nation or city name (e.g., some place on the planet). The area indicated in the client’s profile has been utilized before to deduce a client’s area, in spite of the fact that it is known to prompt low review [38]. Here, we utilized this approach, utilizing a database to decipher client areas as a pattern, and investigated whether, how, and to what degree a classifier can beat it. For this pattern approach, we question GeoNames with the area string determined by the client and pick the main choice yield by the administration. To influence a more attractive correlation with our classifiers, since GeoNames to won’t have the capacity to decide the area for clients with a vacant area field, we default GeoNames’ expectation for those tweets to be the dominant part nation, i.e., the United States.

### Classification Results

In this segment, we introduce comes about for various area characterization tests. To begin with, we take a gander at the execution of classifiers that utilization a solitary element. At that point, we show the outcomes for classifiers joining numerous highlights. To finish up, we inspect the outcomes in more profundity by taking a gander at the execution by nation, and mistake examination.

#### Single Feature

Table 2 shows the outcomes for the order on the TC2014 dataset with two distinctive methodologies utilizing GeoNames, one in light of populace (the most crowded city is picked when there are diverse choices for a name) and one in view of significance (the city name that most looks like the information string). In this dataset, 65.82% of the tweets have a non-purge string in the area field; for whatever is left of tweets, we pick
the most well known nation in the dataset as the yield of the approach in light of GeoNames. The table shows estimations of smaller scale and full scale precision.

There is no huge distinction between the two methodologies in light of GeoNames when we take a gander at miniaturized scale precision. How-ever, this exactness is marginally better disseminated crosswise over countries when we utilize the approach in view of pertinence, as can be seen from the full scale precision esteems. In what tails, we consider the importance based GeoNames approach as the gauge that exclusively depends on a database coordinating the client’s profile area and contrast and the utilization of classifiers that endeavor extra highlights accessible in a tweet.

Table 2: Classification results using GeoNames.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Microacc</th>
<th>Macroacc</th>
<th>MSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>population</td>
<td>0.505</td>
<td>0.317</td>
<td>1505.661</td>
</tr>
<tr>
<td>relevance</td>
<td>0.304</td>
<td>0.342</td>
<td>1505.566</td>
</tr>
</tbody>
</table>

Table 3 shows the grouping comes about, each case making utilization of just a single of the eight highlights under examination. This table incorporates execution esteems when we connected the classifier on both datasets, TC2014 and TC2015. The extra column, “Diff.”, demonstrates the relative distinction in execution for each of these datasets, i.e., estimating the degree to which a model gained from the TC2014 dataset can in any case be connected to the TC2015 test set. Note that while higher qualities are wanted for miniaturized scale precision and full scale exactness, bring down qualities are ideal for MSE.

On the off chance that we take a gander at the miniaturized scale exactness scores, the outcomes suggest that three methodologies emerge over the rest. These are tweet content, tweet dialect and client dialect, which are the main three ways to deal with get a small scale exactness score over 0.5. In any case, these three methodologies come up short when we assess them in view of full scale precision scores, and in this way they neglect to adjust the order well. Rather, the clients’ self-detailed area (client area) accomplishes the most astounding full scale precision scores, while miniaturized scale exactness scores are just marginally lower. This is because of the way that the classifier that lone uses the client’s profile area will have the capacity to figure accurately a couple of cases for each country attempt where clients determine an effectively spelled, unambiguous area, yet will neglect to order accurately the rest; consequently the higher full scale precision is sensible as indicated by these desires. The MSE blunder rates propose that tweet substance and tweet dialect are the best in getting the most proximate orders. We trust this is because of the closeness of numerous nations that talk a similar dialect (e.g., German and Austria, or Argentina and Chile), in which case the classifier that depends on tweet dialect or substance will regularly pick a neighboring nation given the likenesses they share regarding subjects and dialect. While the vast majority of these classifiers outflank the GeoNames gauge as far as smaller scale precision, client area is the main component to beat the standard as far as large scale exactness. In any case, the little change over the gauge recommends that option approaches are required for a superior adjusted arrangement execution.

Figure 3 shows a warmth outline precision estimations of every one of the highlights separated by nation. We watch the best conveyed precision crosswise over nations is with the utilization of client area as an element. In any case, different highlights are improving characterizing tweets that have a place with a portion of the significant nations, for example, the USA (better ordered by tweet dialect or client dialect), Russia (better arranged by tweet dialect) or Brazil (better grouped by tweet language, user name or tweet content). This accentuates the need to investigate encourage the contrasts between every nation’s qualities.
Table 3: Classification results with a Maximum Entropy classifier on a single feature for all the countries in TC 2014 and TC 2015. The last column “Diff.”, shows the relative difference in performance for each of these datasets.
Table 4: Classification results with a Maximum Entropy classifier on a single feature for the top 25 countries in TC2014 and TC 2015.

As we noted over, an amazing normal for our datasets (and the truth of Twitter itself) is the high imbalance in the dissemination of tweets crosswise over nations, where a couple of nations represent a huge dominant part of the tweets and numerous nations in the tail represent not very many tweets. The way that the classifier needs to figure out which of the 217 nations a tweet has a place with significantly confuses the undertaking. To evaluate this, and to investigate the capacity to support execution on the nations with most astounding nearness, we likewise performed arrangement probes the main 25 nations. These best 25 nations represent upwards of 90.22% of the tweets; therefore, having the capacity to help execution on these 25 nations, while expecting that the framework will miss the rest, can make it a more achievable undertaking where the general execution gets moved forward.

To play out the grouping on the best nations, we expelled the tweets from nations that don’t have a place with the best 25 list from the preparation set. Counting tweets from the rest of the nations would add a boisterous class to the preparation set, given the decent variety of that new classification. Be that as it may, for clear reasons, we can’t do likewise for the test set. For the motivations behind experimentation, we appoint whatever remains of the tweets in the test set an alternate, 26th name, implying that they have a place with different nations. Our investigations on the main 25 nations will then have a preparation set with 25 classifications to gain from and test sets with 26 classes, where the classifier will never foresee the 26th class.

Table 4 demonstrates the outcomes for the analyses on the best 25 nations. The general propensity is fundamentally the same as that of the classifiers connected to every one of the nations on the planet, with a normal general lift in full scale precision esteem. In any case, we see a generous change with the utilization of substance as a component, which currently beats tweet dialect in miniaturized scale precision scores and additionally client area in full scale exactness scores. Tweet content really turns into the best performing highlight with the decreased arrangement of 25 nations. Arrangement on a lessened subset of nations can generously help execution, notwithstanding accepting that piece of the dataset will be misclassified. Indeed, order on this upgraded setting beats by a long shot the gauge utilizing GeoNames. Not exclusively does the best performing highlight, tweet content, enhance its execution. Different highlights that performed inadequately previously, for example, tweet dialect, time zone or client dialect, perform essentially better, likewise outer-shaping the GeoNames benchmark. This further rouses our ensuing objective of contemplating blends of highlights to additionally help the execution of the classifier connected to the main 25 nations.

**Conclusion**

To the best of our insight, this is the principal think about performing a far reaching investigation of the value of tweet-intrinsic highlights to naturally gather the nation of starting point of tweets in a continuous situation from a worldwide stream of tweets written in any dialect. Most past work concentrated on arranging tweets originating from a solitary nation and henceforth expected that tweets from that nation were at that point recognized. Where past work had thought about tweets from everywhere throughout the world, the arrangement of highlights utilized for the grouping included highlights, for example, a client’s informal organization, that are not promptly accessible inside a tweet as isn’t doable in a situation where tweets should be classified continuously as they are gathered from the spilling API. In addition, past endeavors to geolocate worldwide tweets had a tendency to limit their accumulation to tweets from a rundown of urban communities, and
also to tweets in English; this implies they didn’t think about the whole stream, yet just an arrangement of urban areas, which accept earlier preprocessing. At long last, our investigation utilizes two datasets gathered a year separated from each other, to test the capacity to order new tweets with a classifier prepared on more established tweets. Our examinations and investigation uncover bits of knowledge that can be utilized viably to manufacture an application that groups tweets by nation progressively; either when the objective is to sort out substance by nation or when one needs to recognize all the substance posted from a particular nation.

Later on we intend to test elective cost-delicate learning ways to deal with the one utilized here, concentrating especially on gathering of more information for under-spoke to nations, so the classifier can be additionally enhanced for every one of the nations. Besides, we intend to investigate more modern methodologies for content examination, e.g. recognition of themes in content (e.g. do a few nations speak more about football than others?), and in addition semantic treatment of the substance. We additionally expect to create better grained classifiers that take the yield of the nation level classifier as info.

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**Conflict of Interest** - Nil

**REFERENCES**


A Rapid Phrasing Search for Encrypted Cloud Storage

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Abstract

Cloud computing has made much vitality for the examination orchestrate beginning late for its different motivations behind premium yet has in like way raise security and affirmation concerns. The point of confinement and access of puzzle reports have been perceived as one of the focal issues in the zone. Specifically, different specialists inspected answers for examine encoded archives set away on remote cloud servers. Cloud enlisting is a progression, which gives inconsequential effort, versatile computational reason for detainment. The most remote point and access of report have been tremendous issue here. While, different plans have been proposed to perform conjunctive watchword look, less thought has been noted. In this paper, we show a verbalization look for procedure in light of create channels, which is speedier than existing structure. Our structures use conjunctive catchphrase request to help functionalities. This approach other than depicted the false positive rate.

Keywords: Bloom Filters, Conjunctive Keyword Search, False Positive Rate, Hashing, Phrase Search.

Introduction

Passed on computing [1] has passed on much fervor for the examination put away in late years. To look at encoded reports set on cloud diverse plans has been proposed yet less thought have been noted on more seek after systems. To vanquish the limit and access of asked for reports set away in cloud. We proposed a clarification scan for using sprout channels which is speedier than existing structure. Our methods use a conjunctive watchword which is drawback of existing structure to escape record speedier and get to secure [2]. This approach in like way depicted the false positive rate for the catchphrase look. Record streams are made and passed on in various structures on the Internet, for instance, news streams, messages, more minor scale blog articles, going to messages, investigate paper reports, web gathering talks, et cetera. The substance of these recorded everything pondered focusses on some isolated gatherings and customers’ characteristics, when in doubt. To mine these bits of information, a great course of action of investigate of substance mining focused on restricting focuses from report collections and record streams through various probabilistic subject models, for instance, set up PLSI, LDA and their augmentation. Manhandling these disconnected topics in report streams, most by far of existing works detached the difference in singular subjects to see and imagine parties and besides customer hones. Regardless, few takes a gander at concentrated on the relationship among different subjects appearing in special records passed on by a specific customer, so some stowed away yet crucial information to reveal changed practices has been dismissed. Reviewing the real focus to portray customer hones in scattered record streams, we consider on the relationship among focuses expelled from these reports, especially the dynamic relations, and pick them as Sequential Topic Examples (STPs) [3]. Each and every one of them records the whole and reiterated lead of a customer when she is passing on a development of reports and are fitting for inducing customers’ trademark characteristics and mental statuses. Idealize off the bats, rose up out of particular subjects, STPs [3] get the two blends and demands of concentrates, so can work decently for as discriminative units of semantic relationship among records in faulty conditions. In like way, showed up differently in association with record-based portrayals, point based cases contain associated information of report substance and are in addition basic in bunching practically identical archives and finding a
couple of regularities about Internet customers. Thirdly, the probabilistic portrayal of subjects keeps up and amass the weakness level of individual fixations and can in this way accomplish high sureness level in configuration preparing for crude data. For a file stream, some STP’s may happen from time to time and in like way reflect regular practices of included customers. Past that, there may even by and by exist some remarkable cases which all around are brilliant for the sweeping framework yet happen everything considered routinely for some specific customer or some specific social affair of customers. We call them User-mindful Rare STPs (URSTPs). Risen up out of visit ones, discovering them is especially charming and basic. Speculatively, it portrays another kind of cases for striking event mining, which can depict patch up and sporadic practices for remarkable customers. All around that really matters, it can be connected in some certifiable states of customer lead examination, as tended to in the running with case. Condition 1 (Real-time seeing on odd customer hones). Starting late, more minor scale web diaries, for instance, Twitter are pulling in a dependably developing number of examinations wherever all through the world. Humbler scale blog messages are reliable, unconstrained reports of what the customers are feeling, considering and doing, so reflect customers’ characteristics and statuses. In any case, the good ‘ol fashioned needs for customers for scattering these messages are hard to reveal doubtlessly from single messages, yet both substance information and transient relations of messages are required for examination, especially for odd practices without prior data. Besides, if unlawful practices are joined, seeing and watching them is particularly creature for government cripple perception. For example, the lottery blackmail hones by systems for Internet commonly accord with the running with four phases, which are exemplified in the purposes behind passed on messages: (1) make allow allurements; (2) diddle other customers’ information; (3) get specific costs by tricking; (4) take unlawful weakening if their requesting are denied. STPs happen to have the capacity to join an advancement of between related messages and would along these lines can catch such practices and related customers. Additionally, paying little respect to whether some unlawful practices are making, and their dynamic measures have not been unequivocal yet, we can at show reveal them by URSTPs, as long as they satisfy the properties of both general rareness and neighborhood reiterate. That can be seen as significant encounters for question and will trigger concentrated on examinations. In this way, mining URSTPs is a sensible means for propelling customer facilitate keeping an eye out for the Internet. In the proposed system of this project, we can reach some objectives. They are:

To decreased the interest time
To associate with the multi catchphrase look into cloud data Scope:

The configuration is likewise adaptable, where reports can no doubt in the world be cleared and added to the corpus.

We moreover portray changes to the strategy to hack down cutoff cost at a little cost fittingly time and to prepare for cloud providers with verifiable data on set away data.

Fig.1: Proposed framework design

Related Work

Subject mining in record aggregates has been extensively studied in the game plan. Subject Detection and Tracking (TDT) errand, anticipated that would see and track topics (events) in news streams with get-together produce procedures in light of catchphrases. Considering the co-occasion of words and their semantic affiliations, a lot of probabilistic generative models for expelling subjects from reports were in like route proposed, for instance, PLSI, LDA and their extensions joining distinctive features of records, and what’s more models for short messages, like Twitter-LDA. In various honest to goodness applications, record accumulations all around pass on fleeting information and would along these lines can be considered as report streams. Indisputable fascinating point showing structures have been proposed to discover subjects after some time in record streams, and a while later to anticipate isolated gatherings. Notwithstanding, these systems were proposed to create the movement model of individual fixations from a report stream, instead of
look at the relationship among various subjects ousted from dynamic records for specific customers. Dynamic diagram mining is a noteworthy issue in data mining and has in like way been especially connected up until this point. In the context of deterministic data, a total report can be found in. The thought reinforce is the most comprehended measure for investigating the repeat of a dynamic layout and is delineated as the number or level of data approaches containing the case in the goal database. Distinctive mining estimations have been proposed in setting of assistance, for instance, Prefix Span, Free Span and SPADE. They discovered standard back to back layouts whose assistance regards are no not as much as a customer depicted edge and were related by SLPMiner to oversee length decreasing strengthen necessities. Before long, the obtained patterns are not dependably charming for our inspiration, in light of the way that those uncommon at any rate immense endeavors tending to balanced and capricious practices are pruned in view of low sponsorships. Additionally, the estimation on deterministic databases isn’t appropriate for record streams, as they disregard to manage the weakness in subjects. For unverifiable data, a large portion of existing works considered never-ending item set mining in probabilistic databases, yet about less investigates kept an eye out for the issue of dynamic case mining. Muzammal et al. focused on outline level powerlessness in unique databases, and proposed procedures to review the repeat of a continuous case in setting of expected help, in the packaging of contender roll out and-test or graph improvement. Since anticipated help would lose the probability advancement of the assistance, an unrivaled measure go over probability was delineated for general itemsets and used as a touch of burrowing unending unique cases for strategy level and part level crude databases. Regardless, these works did not consider where the questionable databases begin from and how the probabilities in the basic data are managed, so can’t be particularly used for our pressure which takes record streams as data. In addition, they in like manner entirely changed watchwords approaches on conjunctive key enunciation looks, which at most recent, researchers have proposed single key explanation disclosures. Besides overhauling the figure incorporate given which discovers STP contender with assessed reinforce regards, this paper presents a dynamic programming-based computation to completely process the assistance estimations of picked STPs, which gives a tradeoff among precision and capability;

- The preprocessing strategies including subject extraction and session seeing affirmation are showed up in detail, where a few heuristic systems are analyzed;
- The formula to figure the relative phenomenon of a STP for a customer is changed as per twist up totally customer specific and more right;
- Experiments are driven for new depends on more good ‘ol fashioned Twitter datasets and more summed up created datasets, and quantitative results for the genuine case are given to affirm our approach.

**Literature Survey**

D. Boneh [7] has proposed a champion among the strongest destroys key verbalization looking. Their strategy uses open key encryption to draw in catchphrases to be available without revealing information content. Waters, [8] inquired about the issue for investigating encoded survey logs. Perpetual early works focused on single key explanation disclosures. Beginning at most recent, researchers have proposed approaches on conjunctive key enunciation looks, which merges changed watchwords [9] [10]. Other interesting issues, for instance, the masterminding of recorded records [11] [12] [13] and looking with key explanations that may contain issues [14] [15] named cushy watchword search for, have likewise been considered. The ability to check for phrases was in like path as of explored [16] [17]
Some have investigated the security of the proposed systems and, where surrenders were found, strategies were proposed with the enlightenments [19]. Open encryption frameworks [20][21] can to some degree fulfill the fundamental for secure given record look. Secure ask for over the encoded cloud information which decreases the estimation. The protection protecting pursuit of records methods and customer underwriting framework are used to deal with the issue of secure multi-level catchphrase channel for various information proprietors and multi-level information customers in passed on dispersed figuring. Subordinate upon PEKS plot [22], a lot of works have by and large stream around the criteria of conjunctive catchphrases look. In the event that at all that the customer is amped up for a few key enunciations of report, the customer may either rely on a joining estimation to pick the correct approach of records or store additional information on the server to empower such interests. Along these lines, open key encryption with conjunctive watchword look (PECK) philosophy is productive to suggest. Typically, PEKS and PECK [21], give a kind of framework that empowers beneficiary to stay messages that contain one or a few particular watchwords by giving an abnormal access emerging from the catchphrases from email server, while the email server and unmistakable other recipient can’t get whatever else about the email. A security guaranteeing demand structure for encoded passed on limit was proposed in Phrase Search for Encrypted Cloud Storage [23]. The system handles symmetric-key encryption and a tree-based pursue structure to keep up question execution and affirmation ask for security. The guaranteed accessible record (BFEST) in the structure is usually worked by the EU and the CSS to decrease calculation and system correspondence expenses of the EU.

Methodology and Discussion

In this approach we used three structure which is used to recuperate data from cloud brisk and secure. The estimation and tradition is used to scramble the records and catchphrase and took the impetus for all watchwords and record to unscramble the record speedier set away in the cloud server. Here we are using a nonstop cloud Drive HQ to store chronicle. In this project we can use “AES algorithm” to get the accurate and correct results.

AES Algorithm:

AES stands for advanced encryption standard. The AES is a specification for the encryption of electronic data established by the US National Institute of Standard and technology (NIST) in 2001. The encryption system utilizes a course of action of astoundingly chose keys called round keys. These are related, close by different activities, on an arrangement of information that holds precisely one square of data? The information to be blended. This gathering we call the state show. You make the running with AES ventures of encryption for a 128-piece square:

- Derive the strategy of round keys from the figure key.
- Initialize the state bunch with the square information (plaintext).
- Add the fundamental round key to the beginning state cluster.
- Perform nine rounds of state control.
- Perform the tenth and last round of state control.
- Copy the last state pack out as the blended information (ciphertext). The reason that the rounds have been recorded as “nine took after by a continue going tenth round” is in light of the way that the tenth-round joins a tosome degree novel control from the others.

The square to be blended is only a social affair of 128 bits. AES works with byte aggregates, so we first change over the 128 bits into 16 bytes. We say, “change over,” meanwhile, truly, it is more likely than not anchored consequently beginning at now. Activities in RSN/AES are performed on a two-dimensional byte bundle of four lines and four zones. Toward the beginning of the encryption, the 16 bytes of information, numbered Do?

Each round of the encryption system requires a development of sets out to change the state gathering. These strategies consolidate four sorts of errands called: Sub Bytes, ShiftRows, Mixcolumns, XOR round keys.

Sub Bytes: This errand is an unmistakable substitution that movements over each byte into a substitute respect. AES depicts a table of 256 attributes for the substitution. You work through the 16 bytes of the state show, utilize every byte as a summary into the 256-byte substitution table, and supplant the byte with the spurring power from the substitution table. Since all
conceivable 256-byte respects are available in the table, you wind up with a totally new outcome in the state appear, which can be reestablished to its novel substance utilizing a backward substitution table. The substance of the substitution table is not fearless; the sections are enrolled utilizing a numerical condition at any rate most use will just have the substitution table set away in memory as a piece of the graph.

**ShiftRows:**

As the name proposes, ShiftRows tackles each line of the state show. Each area is swung to the opposite side by a specific number of bytes as takes after:

- 1st Row: rotated by 0 bytes (i.e., isn’t changed)
- 2nd Row: rotated by 1 byte
- 3rd Row: rotated by 2 bytes
- 4th Row: rotated by 3 bytes

For instance, if the Shift Rows undertaking is related with the conveying state bundle.

**Mix Columns:** This development is the most troublesome, both to clear up and perform. Every region of the state demonstrate is masterminded self-governing to make another section. The new region replaces the old one. The managing fuses a framework duplication. In the event that you are not comfortable with framework number juggling, don’t get to concerned? It is to an extraordinary degree only a steady documentation for indicating assignments.

**XOR RoundKey:** After the MixColumns development, the XOR RoundKey is incredibly central honestly and scarcely needs its own name. This endeavor in a general sense takes the present state show, XORs the estimation of the most ideal round key, and replaces the state bunch with the outcome. It is done once before the rounds begin and after that once per round, utilizing every single one of the round keys in this way. AES algorithm provide more security.

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**Fig 2: Summary of AES Encryption**

The Features of AES Algorithm:

- AES is a block cipher with a block length of 128 bits.
- AES process the 128-bit data, 128/192/256- bit keys.
- AES is stronger and faster than TDES (Triple-Data Encryption Standard).
- AES algorithm provide full specification and design details.
- The software implementation in “C and Java”.

The modules used in the project: System framework, DataOwner, Data User, Cloud server.

**System framework:** In this framework, we plot a standard catchphrase scan for custom. In the midst of setup, the data proprietor makes the required encryption keys for hashing and encryption errands. By then, all reports in the database are parsed for watchwords. Grow channels settling to hashed watchwords and n-grams are affixed. The reports are then symmetrically encoded and exchanged to the cloud server. To add documents to the database, the data proprietor parses the records as in setup and exchanges them with Bloom channels associated with the cloud server. To expel a document from the data, the data proprietor in a general sense sends the request to the cloud server, who releases the record close to the joined Bloom channels. To play out an interest, the data customer enters watchword then it
figures and sends a trapdoor encryption of the kept an eye on catchphrases to the cloud to begin a custom and returns review record. Here we execute a few modules they are Data Owner, Data User and Cloud Server.

**Data Owner:** In Data Owner module, Initially Data Owner must need to pick their detail and after login he/she needs to declare their login through OTP. By then data Owner can move records into cloud server with encoded watchwords and hashing estimations. He/she can see the records that are moved in cloud. Data Owner can guarantee or expel the record request sent by data customers.

**Data User:** In Data User module, Initially Data Users must need to enroll their detail and a short traverse later login into cloud. Data Users can glance through each and every one of the records exchange by data proprietors. He/she can send request to the records and from that point on request will send to the data proprietors. In case data proprietor reinforces the request then he/she will get the unscrambling key in picked mail

**Cloud Server:** In this module, we make Cloud Server module. In Cloud Server module, Cloud Provider can see each and every one of the Data proprietors and data customers’ unnoticeable fragments. CP can fit see the records in cloud exchanged by the data proprietors.

**Experimental Results**

Information proprietor should login to the cloud server to move records in the cloud. While Register is done the OTP sends to the proprietor mail. Exactly when the OTP is checked then the presentation page of Data Owner will be appeared.

Information client other than need to login in the cloud. The bit of the customer is to glance through the report exchanged by the customer. While, enlist is done the data customer profile inviting page will be appeared.

The data user requested record is ensured. The unwinding key is send to the customer mail. By using the key customer get the right record snappier and the report will be moored in the cloud.
Fig 7: check unscrambling key

The record looked for by customer is get speedier in a brief moment what’s more dataowner report will be secured by using this framework.

Fig 8: User get correct document speedier

Fig 9: Total Time Delay to Upload the Data

The false positive rate is calculated as the ratio between the number of negative events wrongly categorized as positive (false positive) and the total number of actual negative events.

The false positive rate is: \( \frac{FP}{N} = \frac{FP}{FP + TN} \).

Where FP is the no of false positives, TN is the no of true negatives and \( N = FP + TN \) is the total no of negatives.

Fig 10: False positive rate (p) as a function of hash function (k) and bits per entry (m/n)

**Conclusion and Future Work**

In this paper, we presented an articulation look for configuration in light of Bloom redirect that is in a general sense speedier than Existing methodology, requiring only a specific round of correspondence and Bloom channel checks. Our approach is in like manner the first to reasonably allow state excitement to run straightforwardly without first playing out a conjunctive catchphrase seek after to see contender records. The technique for working up a Bloom direct record attracts keen check of Bloom diverts dubiously from inquiring. As showed by our examination, it moreover achieves a lower hoarding cost than each and every present methodology near where a higher computational cost was exchanged for hacked down limit. While seeming close correspondence cost to driving existing courses of action, the proposed plan can in like way be changed by achieve most unquestionable speed or smart with a sensible collecting cost subordinate upon the application.

**Ethical Clearance** - Not required

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**References**


Relevant Web Revisitation by Context and Content Keywords

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Abstract

Retuning to the previously viewed web page is a common yet uneasy task to the large volume of personally accessed information on the web. This paper leverages humans natural recall process of using episodic and semantic memory cues to facilitate recall and personal web revisitation technique called web page prev through context and content keywords. The episodic memory means that it used for incidental memory and also used for a context (graphical) semantic memory used for a webpage in (day to day) that include content keyword. Relevance feedback mechanism is also involved to tailor individual’s memory strength and revisitation habits. Compared with the existing web revisitation tool memento, dynamic management of context and content memories. There relevance feedback, the finding a web page prev aamong time, location and activity context content based re-finding. Delivers the best performance, compared to context based re-finding and content based re-finding.

Index Terms- web revisitation, access context, page content, relevance feedback

Introduction

The web is playing a significant role in delivering information to users. A web page can be localized by fixing the page content as time varying snapshort. The common web behavior’s, web revisitation is to re-find the previously viewed web pages, not only the page URL, but also the page snapshot at the access time stamp. The human’s rely on the both episodic memory and semantic memory to recall information or events from the post. Human’s episodic memory receives and stores temporally dated episodes or events, together with their spatial temporal relations, human’s semantic memory is a structured record of facts meaning, concepts and skills that on has acquired from the external world. The differences of users in memorizing previous access context and page content cues; relevance’s feedback mechanism is involved to enhance personal web revisitation performance. A number of techniques and tools like bookmarks, history tools, search engines, metadata annotation and exploiting contextual recall system. The context information are using a access time location and concurrent activities automatically inferred from user’s computer programs. Extracting content items from the full web page as we extract them from page segment display on the user’sview. Other closely related work enabled users to search for contextually related activities.

Fig (1): The personal web revisitation framework

Context information includes access time, location and concurrent activities automatically inferred from User’s computer programs. Instead of extracting content items from the full web pages. Context acquisition and management of user’s previous access context and content related information to prepare for user’s web revisitation [2] a Part from access context, users may also get back to the previous viewed pages through some content keywords. Extraction from the web page segments displayed on the screen in the user’s
page browsing well as page’s subject headings the and term frequency inverse document frequency and reflecting user’s impression and recall content cues. Our personal web revisitation framework with relevance feedback. They are two phases (1) preparation for web revisitation: When a user accesses a web page, which is of potential to be revisited later by the user. Context acquisition and management module captures the current access context (i.e. access time, location, activities inferred of currently running computer programs) into a probabilistic context tree content extraction management performs the unigram based extraction from the displayed page segments and obtains a list of probabilistic content terms. (2) Webrevisitation: When a user requests to get back to a previously focused page through context and/or Content keywords, the re-access by content keywords module and re-access by content keywords modules search the probabilistic term list repository. The main contributions of the paper three aspects. Web page prev: A personal web revisitation technique Calles webpage prev, acquisition, storage and utilization for web page recall dynamic tuning strategies to individual’s memorization. Proposed technique: The web page prev and report the findings portance of context and content factors.

Literature Survey

A personal web revisitation can be utilize by number of techniques, book marks, History tool, searchengine’leveraging engine’s, leveraging access context and page content, metadata Annotation and exploitation, and contextual recall systems.

(i) Bookmarks:

A web page in manually/automatically bookmarking favorite web pages in web browser enables users to get back to the previously accessed pages. According to user’s every visited web page and browsing preferences, [12][13]a few of the bookmarks personal toolbar, so that the user can access the desired web page through a single mouse click[19]. Recommended visited pages relevant to the currently viewed pages, and presented them in a dynamic browser toolbar.

(ii) History tools:

History tools of the web browsers maintain user’s accessed urls chronologically. According to visit time (e.g., today, yesterday, last week, etc) which can be use to develop Guidelines for the design of history mechanism success of a web page. Contextual web history it used for improved the visual appearance of the web browser history by time. Virtual history tool [18] encoded four features of a web page, which consists of user’s pages. Search panel combined web page and process metadata into an interactive representation of the documents.

(iii) Search Engines:

How search engines are used for re-finding previously found search results. It explored the differences between queries that had substantial / minimal changes between the previous query and the revisit query. Relevance feedback [12] covers a range of techniques intended to improve a user’s query and facilitate retrieval of information relevant to a user’s query modification.

(iv) Metadata Annotation and Exploitation:

Haystack stored arbitrary objects of interest to a user, and recorded arbitrary properties of and relationship between the stored information. It coined a uniform recourse identifier (URL) to name anything of interest, including a document [16], command/menu operation, or an idea. Once named the object can be annotated, related to other objects.

Methodology

Preparation for web revisitation:

The acquisition and management of user’s previous access context and content related information to prepare for user’s web revisitation.

Context Acquisition and management module

Context Acquisition:

Three kinds of user’s access context, i.e. access time, access location and concurrent activities, are captured while access time is determine, access location can be derived from user registration. Users may also get back to the previous viewed pages through some content keywords. Instead of extracting content terms from the full web page, we also extract data from Visited pages. e.g.: Ip localization API we can map the IP address (e.g. “166.111.71.131”) to region (e.g.:”Beijing, t.singha, university”) once a user visits a web page longer than a threshold Te, computer programs that run interleaving with the current web access program.
Construction of probabilistic context Trees: Web page access context is organized in a probabilistic context tree to support generalized revisit queries due to human user. The time complexity of building context tree is \( O(\text{nc.h} + \text{nc.h}[\text{c}]) \) Where \( \text{nc} \) is the number of captured context instances \( [\text{c}] \) is the average instance length and \( h \) is the height of context tree.

Fig (2): Probabilistic context tree of the web page access program

The probabilistic context tree used for access the web pages. A leveled probabilistic context tree example for \( w \), whose activity leaf nodes correspond to context activities. Busy context node is a general activity status to describe whether the associated computer programs are concerning about working or learning. A Dewey code is a widely used coding scheme for tree structure, where each node is assigned a Dewey number to represent the path from the root to the node. For example a tree node \( n \) encoded as \( n1, n2, ... nk \) is descendant of tree node \( m \) encoded as \( m1, m2, ... mf \). The Dewey number of the root is actually the tree id. For each node in a probabilistic context tree, a Tries-based index according to its keywords. Each leaf node is bounded with a score in \([0, 1]\) stating the like hood that this context node is used as a contextually cues.

Decay and reinforcement of probabilistic context trees:

The probabilistic context trees will evolve dynamically in life cycles to reflect the gradual degradation of human’s episodic memorization as well as the context keywords that user’s will use for recall. Each node in the probabilistic context tree, its association score will progressively decay with time.

Fig (3): Probabilistic term list extraction and management of the focused web page \( w \)

A part from memory degradation, the probabilistic context tree may also experience reinforcement due to user’s revisit queries. That is, if user types in a context value in the context tree, its possibly degraded association score is reset to the original one, and all its ancestors’ scores are also re-computed based on this original values. The decay starting time for its located level is mean while reset to the current time.

Content Extraction and management module:

Personalized web revisitation, merely counting the occurrence of a term in the presented page segment is not enough. Also user’s web page browsing behavior’s as well as pages subject headings are counted as user’s impression and potential interest indicators for later recall web page. To gain the speed benefits of indexing at retrieval time, we apply tries tree to organize the extracted term lists based on the longest common prefix. Within a target page Collection, we assume that each page has a unique serial number, known as the page identifier (page id). The dictionary records some statistics, such as the number of web pages that contain each term (page freq) which also corresponds to the length of each postings list. And postings list of pairs of impression score \( dIs (w, d, t) \) and page id for term \( d \).

WEB REVISITATION BY CONTEXT AND CONTENT KEYWORDS

New each user’s accessed web page \( w \) is bounded with a probabilistic context tree (denoted as \( w\#\text{tree} \)) and a probabilistic term list (denoted as \( w\#\text{list} \)). Let \( w \) be the set of user’s previously accessed web pages.

Algorithm 1: Web Revisitation Algorithm

Input: a revisit query \( Q (w, Qx, Qy, t) \)
Output: Wm

1 Begin
2 Declare Trees variable and assign getMatchContextTrees (W, Qx, t);
3 Declare Lists variable and assign getMatchTermList (W, Qy, t);
4 for each start WcWx do
5 split w# into n smallest sub trees w# Subi (i=1,--n)
6 for i=1; i<n; i++ do
7 For each (Lin sub i) do
8 If L has matched child node in Lsubi then
9    Deleted L from Lsubi
Else MAS (Qx, l, t) = Qlt.title/t.title CAS (W, l, t)
9    Crank (W#treesubi|Qx, t)
10 drank (W#tree |Qt,t) =dls (W,qy,t)
11 Rank (w, Q, t) = Crank (w# tree, Qx, t)
12 for each (w in WC) do
13 if rank (w|Q,t) <alpha* Rank (Wx, Q,t) then
14 determine WC by deleting w from Wc
15 Wm = Quick sort (Wc|Q,t)
16 Ends

A web page w satisfies query in the scanning the inverted index, the candidate matched page set Wc can be determined based on the matched context tree and the matched term lists against a revisit query Q. To compute context ranking, it’s firstly splits the matched context tree into multiple satisfactory sub trees, than traverses the matched nodes. After calculating the matching score, we can determine each sub trees, ranking score and add them up by the content keywords. After calculating the matching score, we can determine the each sub tree’s ranking score of the web page. Qx is a set of context keywords, Qy is a set of content key words, and answer Wm is a ranked list of matched web pages from W. We firstly determine the matched node l in L, we calculate the mass is a considering the ancestor node Li with a matching child nodes. Crank (W# treesubi|Qx, t) the calculate by multiplying impression score of each content key words.

(i) Relevance Feedback

Relevance feedback is an interactive approach that has been to work particularly well in classical information retrieval and more recently in web, when a user interacts with web page prev during web revisitation phase, he cans either manually enters some context keywords.
Fig (4): Suggested values for context keywords input

Web pages of he left side buttons of time, location, and activity. Each contextual hierarchy is dynamically maintained by analyzing the user’s clicking behaviors and the statistical frequencies of captured context instances. The web revisitation engine gets to know the system performance, and tune related influential parameters to improve it gradually. Frequently accessed context items are top listed in the corresponding contextual hierarchy. User’s type in re-finding requests are automatically corrected by the system based on its indexed content and context keywords.

ii. Performance Metrics

The web revisitation performance metrics include pages finding rate, average precision average recall and average rank error for a set of re-finding requests.

(1) The finding of revisitation Q is: \( \text{Find}(Q) = 1 \) if the user confirms one or more relevant result pages (i.e \( m>0 \))

(2) The precision of revisitation Q is: \( \text{precision}(Q) = \frac{m}{n} \)

(3) The recall of revisitation Q is: \( \text{Recall}(Q) = \frac{m}{u} \)

Let Q be a set of user’s web revisitation requests. The finding rate, average precision, average recall and average rank error of Q are define

iii. Influential parameters to be tuned

The parameters used in constructing and managing probabilistic context trees. Parameters used in constructing probabilistic content term lists.

iv. Tuning Strategies

The parameters tuning is carried out when any of the following three conditions.

Periodically (say, once every two weeks since last tuning)

When one of the performance metrics drops below a threshold (eg. \( T_{\text{findRate}}=0.8, T_{\text{Precision}}=0.2, T_{\text{rankerror}}=0.4 \)) since last tuning.

When user presses “>>>” button at the right-bottom of the screen. If s/he is not satisfied with the result

<table>
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Step1: Optimize the settings of weight vector and ensure user’s confirmed relevant result pages higher than unconfirmed one’s, when a user’s confirms two or more pages as relevant, the confirmed pages nodes are firstly clustered as a set.

Step2: Decrease the context and content focus duration thresholds \( T_c & T_d \) by half and doubly acquisition.

Step3: Adjust leveled decay rates of context trees according to hierarchical levels of context keywords.

Step4: Decrease the when confirmed pages with lower ranking score are still removed from result list

After step.

Evaluation

Experimental setup

Web page pre, memento history list searching and search engine. Web page prev and memento on each user’s re-finding task, four different methods are to be invoked. We then provided the following instructions to the user’s before starting the experiment each user is suggested to execute at least one re-finding task per day for each re-finding task, four different methods are to be invoked. The execution sequence is random. When using webpagerev to do re-finding, context keywords and content keywords. The user’s should connect the external Gaps module with the laptops when they are outside the Campus At the end of re-finding task, the user’s should record their search keywords, they number of target Pages they looked for ranking positions of the returned target pages, and the length of result of result Page list.
Performance comparison with existing approach

We can see the number of three query types in three re-finding time intervals, where re finding days $\text{dayR}$ is the elapsed days since the page was accessed. The results show users are more dependent on episodic memory cues when searching for the target page with a longer $\text{dayR}$. We compare the performances of our personal web revisitation approach with three conventional methods. Web page prev delivers the best average A-measure about 2.15 times and 1.29 times. When web revisitation by web pages using a different query types of the refinding a days. 10-20 days to increase the hightest queries. The web page prev to ratios of the query keywords to revisit the pages. Fig (b) the ratio of a query keywords belongings to different context hierarchical levels and page segments in different re-findings time intervals.

Effectiveness of memories decay and relevance feedback:

When the through removing decay and relevance feedback mechanism from webpageprev, We evaluate effectiveness by comparing four different cases (i) without decay(wd) (ii) without relevance Feedback (iii) without decay and relevance feedback(wdf) (iv) with decay and relevance feedback(df) Df’s finding rates increase by 0.88% ,average increase by 15.27% and average rank error and decrease By4.71%than Wd. In comparison with stable memory management strategy.

Effectiveness of weight adjustment in relevance feedback

We evaluate the effectiveness of weak partial ordering graph (WPOG) by comparing the performance with possible orderings tree (POT).

Contribution analysis of context and content factors.
The importance of different factors in web page prev, we divide revisit queries into three types:

- Querying based on connect keywords only
- Context keywords only
- Context and content keywords.

WPOG’s finding rate increase by 3.19%, average increase by 11.38% and average rank error decrease by 8.23% than POT. The POT makes assumptions for the weight coefficients, which should satisfy a uniform distribution.

Performance comparison between context and content factors in web page prev

| TABLE (1): performance comparison between context and content factors in web page prev |
|----------------------------------|-----------------|-----------------|-----------------|
| keywords                        | Average precision | Average Recall  | Average F1-measure |
| Content                         | 0.1322           | 0.8283          | 0.2280           |
| Context                         | 0.2501           | 0.8621          | 0.3877           |
| Content+context                 | 0.3011           | 0.9121          | 0.4527           |

The main reason for these performance differences could lie in the number of query keywords. The behaviors of time, location and activity contextual elements in web page prev. The reason is due to the smallest search space of activity context compared to that of time and location context.

| TABLE (2): performance comparison between context and content factors in web page prev |
|----------------------------------|-----------------|-----------------|-----------------|
| Context Factor                   | Finding Rate    | Average Rank error | Average precision | Average Recall  | Average F1-measure |
| Time                            | 0.8873          | 0.3474           | 0.2574           | 0.8681          | 0.3971            |
| Location                        | 0.8716          | 0.3907           | 0.2433           | 0.8533          | 0.3786            |
| Activity                        | 0.9192          | 0.3221           | 0.2950           | 0.8922          | 0.4434            |
| Time + Loc                      | 0.9066          | 0.3423           | 0.2850           | 0.8784          | 0.4252            |
| Time + Act                      | 0.9491          | 0.2630           | 0.3149           | 0.9344          | 0.4711            |
| Loc + Act                       | 0.9379          | 0.2857           | 0.3013           | 0.9207          | 0.4540            |
| Time + Loc + Act                | 0.9443          | 0.2489           | 0.3414           | 0.9309          | 0.4996            |

Experiments on Synthetic Data

Assume a user has accessed and focused total_page_num (np =100k,200k,….,1M) web pages. Associated with each web page, there is a probabilistic context tree and a probabilistic content term list, over which user’s re finding requests are executed. Each context tree has 4 hierarchical levels with context node num (n=20,25,…;50) tree nodes in total. The node number at level 1,2 and 3 occupies 70%,20%,and 10% of the total node number.
Fig (9): Average revisitation response time on synthetic data

We can find that the average response time increase accordingly with the increase of n and nt. More pages being context trees and term lists need to be checked thus more time to process the revisit queries. On the response time does not increases sharply with nk.

Conclusion

Drawing on the characteristics of human brain memory in organizing and exploiting episodic events and semantic words in information recall, this paper presents a personal web revisitation technique based on context keywords. Context instances and page content are respectively organized as probabilistic context Trees and probabilistic term lists, which dynamically evolve by degradation and reinforcement with relevance feedback. Our experimental results demonstrate the effectiveness and applicability of the propose technique.

Ethical Clearance - Not required

Source of Funding- Self

Conflict of Interest - Nil

References

Development of 3D Model of Tibia Femoral Bone in Knee Joint for FEA

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Abstract

Tibia femoral bone is a part of knee joint which is a very complex joint of the human body. Now a days knee pain is most frequently observed problem in elderly people. Worldwide statistics reveals about 100 million people experience knee pain hence analysis of knee is very essential for diagnosis and treatment. The change in mechanical properties of knee joint lead to knee bone fracture. Loading of the knee bone and possible fracture can be analyzed using finite element analysis (FEA). The FEA technique used for analyzing mechanical properties of complex knee bone structure which needs 3D model of knee joint bone. This work mainly focuses on segmentation and 3D rendering of tibia femoral bone from MRI/CT scan data using image processing techniques. Interactive segmentation technique is used for segmentation of tibia femoral bones. Using the segmented images 3D volume rendering is done and 3D model of tibia femoral bone is developed. Finite element meshing technique is carried out on 3D model of tibia femoral bone to create meshed model and the developed model can be used for analysis of force during loading using finite element analysis. The developed interactive segmentation technique along with 3D model creation of bone is useful in analysis and surgery planning.

Keywords—: MRI, knee joint, segmentation, 3D model, Finite element analysis.

Introduction

The knee joint is the strongest synovial joint, carries the weight of the body during physical activities. Due to injuries, getting age and pathological function causes the knee pain. Analysis of knee is very important for studying mechanical properties of bone. The proposed algorithm provides segmentation of knee joint 3D rendering of tibia femoral bone for analysis. Finite element method is a technique where the complex structure is divided into many finite elements. These finite elements are used to generate the mesh to study individual behavior of elements. In bone volume a mesh generated to form a three dimensional structure. Volume meshes are usually triangulation, tetrahedrons and hexahedrons [1]. Figure 1 shows the anatomy of knee joint.

Figure 1: Anatomical structure of knee joint

The femur bone is studied by identifying natural frequency response when sudden external load is applied also by varying material properties and boundary conditions. These natural frequency avoids the damage of the femur bone [2]. Application of finite element model of bone can be used for analysis of stress and strain, finding mechanical properties, structure of bones and load estimation for the treatment [3]. FE model also predicts the stress of bone with osteosarcoma by applying weight, certain level of pre surgical planning.

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and design of bone plates for disease from CT/MRI scan images \[^4\]. The assessment of bone strength for disease like osteoporosis were studied by Cheng et al and also created model help to study risk factor of fractured bone \[^5\]. FE model of knee bones was generated from the contour points obtained from CT/ MRI scan by Chawla et al i.e. developing finite element meshed model without solid modelling is an advantage \[^6\]. A three dimensional solid model of the knee joint is developed using this 3D model different stresses are studied by Mallesh et al. A polyethylene chopped carbon fibre and alumina ceramic combination of this model also helps in minimizing stress \[^7\]. Using finite element method replacing damaged bone with plastic and metal components, reforming the damaged surface of the knee and three dimensional model is generated by Nishant et al \[^8\]. The mechanical strength of bones and analysis the bone mineral density is done by Sangeetha et al. These analysis differentiate normal and abnormal tissues of femur bone\[^9\]. A finite element analysis method explains the deformation and stress distribution on the femur bone and also finds the portion subjected to maximum stress and deformation \[^10\]. Picture of finite element mesh generating field was explained by Le et al, these mesh generation methods are classified and estimated. The estimation provides an idea for three dimensional mesh generation \[^11\]. Ashwin et al proposed using finite element analysis technique stress distributed in knee joint was studied by reconstructing 3D model of knee joint by segmenting required components of knee joint from MRI image data \[^12\]. Finite element model is used to study the biomechanics of normal and abnormal of knee, the model was observed from different directions and angels by Yunfeng et al \[^13\]. 3D model is also used in many applications like prosthesis design and treatment planning over surgical simulation \[^14\].

The objective of this work is to develop image processing steps for segmentation and volume render tibia femoral bone and to develop finite element model for analysis.

**Methodology**

MRI of knee images were collected from hospital, removal of noise is done using median filter. Region of interest is extracted from preprocessed image using interactive segmentation method. Using these segmented images 3D volume rendering of tibia femoral bone is done. Finite element 3D model of knee joint is created by meshing operation. Figure 2 shows the block diagram of image processing steps of segmentation and 3D reconstruction of tibia femoral bone.

**Image Database**

CT/MRI of knee joint are obtained from JSS Multispecialty Hospital, Mysuru. These images were in DICOM (Digital Imaging and Communication in Medicine) format. Data contains 67 knee slices with T1 sequence, the pixel area of each image is 314x314 by slice spacing 0.3 mm and the images were sagittal and axial plane. Figure 3 shows input MRI of knee joint in two different plane figure 3 (a) sagittal and figure 3 (b) axial imaging plane. The algorithm is designed and implemented in MATLAB (version 2017a).
Preprocessing

Preprocessing is a technique used to suppress the unwanted distortions and to improve the image quality for processing and analysis. MRI of knee joint were DICOM and converted to PNG format in grayscale. Images consist of noise which is removed to improve the image quality. In order to remove the noise image filtering is carried out using median filter. Median filter is a nonlinear filter used to remove noise from the image also preserve image characteristics like lines and edges.

Output of median filter is given by

\[ g(x, y) = \text{med}(f(x - i, y - j), i, j \in W) \]  

(1)

Where \( f(x, y) \) is input image and \( W \) is window size of NxN. In median filter window of size 9x9 moves over pixel by pixel displacing each pixel with median pixel of neighboring values.

Segmentation

Segmentation is a process of separating ROI from other parts of image as well identifies the region to be extracted. To develop a three dimensional model of tibia femoral bone segmentation procedure is carried out on MRI images. In order to separate the tibia femoral bone region from knee joint images an interactive segmentation algorithm is used. Figure 4 represents the process and outcomes of preprocessing and segmentation of MRI images.

3D Model

After segmentation process, sixty seven 2D images pertaining to a knee joint representing the tibia femoral bone at different stages are gathered together in one 3D image dataset. From these segmented images virtual 3D model is developed representing the extracted bone of a region. Developing 3D virtual model of bone starts with sequential arrangement of all segmented images, image slices were arranged according to the slice location thus establishing a 3D image stack i.e. stacking segmented slices on top of each slice from tibia to femur forming a model. The probability of pixel (voxel) in 3D model has intensity value is given by

\[ P(I) = \sum_{i=1}^{n} p_i p_i(I) \]  

(2)

Where \( n \) is the number of materials in 3D model, \( p_i \) is the percentage of materials \( I \) in a voxel, and \( p_i \) is the probability that material \( i \) has a value, with this process it is feasible to develop a 3D model of tibia femoral bone.
Finite Element Meshing

The developed 3D model was converted to FE model by meshing techniques which divides the tibia femoral bone into unstructured meshes. Unstructured meshes were created using Delaunay triangulation technique and meshes are distributed within the 3D model of bone for finite element analysis. Figure 6 shows the developed 3D finite element model of tibia femoral bone. Figure 6(a) 3D model, figure 6(b) contours of 3D model and figure 6(c) shows meshed model.

FEA is a numerical based technique used for finding the strength, stress and behavior of complex structures also used to analyze the deflections of bone under loading.

Results

MRI knee slice were in DICOM format and converted to PNG. Median filter is used to remove the noise from MRI knee and the process is evaluated by calculating SNR (signal to noise ratio) of 41.66 dB. The ROI is extracted from the images using Interactive segmentation algorithm and the segmentation process is evaluate with minimum MSE (mean square error). Figure 7 represents all 67 slice of binary and segmented images arranged sequentially from tibia to femur forming 3D geometrical model figure 7(a) shows 3D model of binary images and figure 7(b) shows 3D model of tibia femoral bone. Finite element meshing is carried out on 3D model of tibia femoral bone by dividing into unstructured meshes. Unstructured meshes are made up of triangular generated by Delaunay triangulation distributed within the tibia femoral bone.

- Preprocessed image
- Estimating ROI
- Selecting vertices (Differentiating foreground and background)
- Binary image (Pixel inside region as 1 rest as 0)
- Overlapping

Figure 5: Interactive segmentation algorithm flow diagram

Figure 6: 3D rendering of tibia femoral bone for FEA (a) 3D model (b) Contours of 3D model (c) FE meshing

Figure 7: 3D model of tibia femoral bone (a) 3D model of binary images (b) 3D model of segmented images

Figure 8 represents the finite element meshed bone surface of tibia femoral bone with unstructured triangular mesh. A 3D finite element model of the healthy knee joint is established with tibia and femur bone. The FE model can be used in different applications like to understand the mechanical properties of soft and hard tissue. Also used as tool for design analysis, implants and bone remodeling.
The development of 3D model of tibia femoral bone in knee joint for FEA algorithm used for finite element analysis of a complex knee structure. Analysis of knee is very important to study mechanical behavior of muscles and tissue for treatment and disease diagnosis.

**Conclusion**

Knee is a complex joint for analysis, the algorithm provides the concepts involved in the 3D reconstruction and finite element meshing of knee joint images, mainly covering the interactive image segmentation process. The developed 3D model useful for finite element analysis to study mechanical properties of bone. There is a scope for future work focuses on to study in detailed way of meshed model and applying boundary conditions, studying deformation of models by applying force.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** - Nil

**References**

Design and Analysis of Low Power VCO Enabled Quantizer for CT Sigma Delta ADC

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Abstract

This paper presents design and analysis of low power Voltage Controlled Oscillator (VCO) enabled quantizer in Continuous Time (CT) Sigma Delta Analog to Digital converter (ADC) using 180nm CMOS technology using Cadence Virtuoso Tool. The VCO based quantizer in Σ-Δ ADC includes loop filter, VCO quantizer and 3-bit feedback Digital to Analog Converter (DAC). The basic building block of loop filter is Operational Amplifier (OP-AMP). The two stage OP-AMP designed offers 61.51dB gain with the unity gain bandwidth of 30.59MHz. The keystone of the ADC is VCO based quantizer clocked at 27.34MHz, which obtains fourth order noise shaping of its quantization noise. A low power VCO is designed using seven stage ring oscillator and Logic Structure Reduction Flip Flop (LRFF) based D-Flip Flop. The VCO based quantizer with CT Σ-Δ ADC consumes a power of 2.57mW with a supply voltage of 1.8V.

Keywords — Continuous time(CT) Sigma delta Analog to Digital converter(ADC), Operational Amplifier (OP-AMP), low power Logic structure Reduction Flip flop (LRFF).

Introduction

Analog to Digital Converters (ADC) blocks are the basic necessity for processing real world data in almost all electronic devices. ADC converts the incoming signal which is analog in nature to zeroes and ones which is digital in nature. ADCs are mainly characterized on their performance and accuracy. A basic functional block representation of an ADC is as shown in the Fig.1.

Different types of ADC architectures are present, the popular and commonly used ADC architecture are Flash or parallel, Pipelined, Successive Approximation register (SAR) based and Σ-Δ oversampling based ADCs. ADCs are chosen based on the target application. Flash ADCs operates at high speed, but occupies more space and consumes more power. Pipelined ADC uses parallelism which helps in increasing throughput of the system and consumes more power. Σ-Δ ADC has high accuracy and resolution but operates at lower speed. SAR ADC has medium to high resolution, Consumes low power and occupies less area but requires anti aliasing filtering and operates at lower speed.

VCO enabled quantization have gained popularity due to its different and simplified signal processing features. Digital circuits form the major building blocks for VCO based ADC’s. Thus helps in technology scaling and also consumes less power. Continuous
time Σ-Δ ADC having VCO enabled quantizer have become booming topic of research and are used in many applications such as radio receivers, audio, wireless receiver, communication etc. [3].

The paper is organized as follows: Section II gives a brief outline of the CT Σ-Δ ADC. Section III illustrates VCO based CT Σ-Δ ADC architecture. Section IV discusses the components designed and results obtained. Section V gives the detail on experiment results. Conclusion based on result obtained is discussed in Section VI.

AN OVERVIEW OF CT SIGMA DELTA ADC

The Nyquist-rate Analog to Digital Converters (ADC) forms the basic building blocks of analog receives front-ends because of its high speed and high resolution application. Oversampling Σ-Δ ADC is one such ADC that can be used in analog front end because of its high resolution and low power consumption.

Among Σ-Δ ADCs, Continuous- time (CT) Σ-Δ Delta ADC’s popularity has been growing in the field Application Specific Integrated Circuits (ASIC). Input frequency range for CT Σ-ranges from 100 KHz to 10 MHz and posses’ inherent anti-alias filtering ability which is as depicted in Fig. 2.

Continuous Time (CT) Σ-Δ ADC has a loop filter, quantizer and a feedback DAC. Analog input is applied to loop filter and its output is given to quantizer which quantizes the input signal to their respective digital levels with the help of sampling signal clock. Output of quantizer is given to feedback DAC which helps in converting digital input to analog output which is fed back to the main input. Discrete time (DT) Σ-Δ ADC lacks inherent anti aliasing property. Incoming analog signal is sampled ahead of the loop filter as shown in Fig. 3.

Discrete Time (DT) Σ-Δ ADC consists of loop filter to which sampled input analog signal is applied. Output of loop filter is given to quantizer that quantizes the input signal into discrete valves and a feedback DAC which helps in converting digital input to analog output which is set back to the main input.

System architecture

The VCO enabled quantizer in CT Σ-Δ architecture is shown in Fig.4. CT Σ-Δ ADC architecture Consists of loop filter which provide noise shaping and linearity and helps in reducing quantization noise. VCO converts the analog input into desired output frequency by the means of $V_{out} = V_{in}*k$ thus allows VCO based ADC to achieve operation at high speed. Return to Zero (RZ) DAC and Non Return to Zero (NRZ) DAC are used in VCO enabled quantizer to maintain the monotonicity.

A. Counter based VCO Quantizer Architecture

The VCO quantizer which incorporates counter based architecture and register to store valve is shown in the Fig.5. The counter thus installed counts the number of edge (positive going) occurring a sampling clock cycle, then register stores the added valves obtained by the counter at individual clock cycle.
The major drawback of this architecture is presence of reset input in counter which is essential but creates issues because the VCO output wave edges occur in very close proximity and resetting of counter takes time due to propagation delay aspects of counter and need for the setup time requirements of the sampling register hence would give erroneous count. To avoid this reset issue the counter based architecture is replaced by phase detector based architecture.

### B. Phase Detector based VCO Quantizer Architecture

This architecture counters are replaced by two D-flip flops and XOR gate. The flip flops are linked in such a way that the output of the 1st flip flop is given to input of the 2nd flip flop where input for first flip flop is taken from the stage of VCO. Both the flip flops are driven by same sampling clock and output from both the flip flop are given to XOR gate which detects whenever there is change in present state which is determined by the output of first flip flop to previous state determined by the output of second flip flop. The phase detector based architecture for VCO quantizer is shown in Fig.6.

The two D flip-flop connected together with a XOR gate is called 1 Bit quantizer is shown in Fig.7.

The Output of the 1 Bit quantizer which is connected to each stages of VCO is given to adders which convert the thermometric code to binary code.

### Design of vco quantizer comprising of lrfis for ct sigma delta adc

Architecture for VCO enabled quantizer for CT Σ-Δ ADC is shown in Fig.8. The building blocks which make up the fourth order filter, VCO based quantizer and 3- bit DAC are built using 180nm technology for the supply voltage of 1.8V.

### A. Loop Filter

Loop filter provides noise shaping property in Σ-Δ ADC. Loop Filter is built using active RC integrator configuration gives high linearity in comparison to Gm-C and MOSFET – C[4]. Loop Filter basically consists of Resistor and Capacitor in low pass configuration and two Stage OP-AMP and when both cascaded together gives the 1st order loop filter. 4th order loop filter is constructed by cascading four 1st order loop filter using 180nm technology is depicted in Fig.9.
The two stage OP-AMP consists of differential stage and common source stage implemented using 180nm CMOS technology is shown in Fig.10. The simulation result obtained for an OP AMP achieves a phase margin of 69.73 degree, DC gain of 61.51dB and unity gain bandwidth of 30.94MHz for input of 1.6V and supply voltage of 1.8V is shown in Fig.11.

The VCO quantizer designed consists of seven stage ring oscillators, D flip flops and XOR gates. Seven stage ring oscillators based VCO is built using current starved technique as shown in Fig.12. The transient response of output taken from individual stages of ring oscillator is shown in Fig.13.

1-bit quantizer constitutes of two D Flip Flops and a XOR gate. LRFF based D Flip Flop [5] and the transient response is shown in Fig.14.

1-bit quantizer designed using two LRFF based D Flip Flops and a XOR gate and transient response of the same is shown Fig.15.
Fig. 15. (a) 1bit quantizer (b) transient response of 1bit quantizer

The thermometer code to binary code converter for VCO quantizer is designed using full adders. Fig.16 shows the 7-bit thermometer code to 3-bit binary code converter using full adders. Simulated result for seven bit thermometer code to three bit binary code is shown Fig.17.

C. Feedback 3-bit DAC

3-bit DAC is a foremost component of the feedback path which converts digital input to analog output. Fig.18 shows the simple 3-bit R-2R DAC and Fig.19 depicts the transient response of 3-bit R – 2R DAC.

Fig.16. 7-bit thermometer to 3-bit binary code converter

Fig.17. Simulated result of Thermometer to Binary code converter using full adders
V. EXPERIMENTAL RESULTS

Designed loop filter, quantizer and 3-bit feedback DAC for VCO enabled quantizer in CT Σ-Δ ADC is integrated in 180nm CMOS technology using Cadence Virtuoso tool. OP-AMP used to build active RC integrator based loop filter provides a DC gain of 61.51dB and unity gain bandwidth of 30.59MHz. Seven stage current starved based VCO provides a output frequency of 3.418MHz at input voltage of 1.8V. LRFF based D Flip Flops used in VCO quantizer consumes a power of 21.43µW. Table I shows comparison of the present work with the available literature considering different performance parameters such as power consumed by VCO quantizer, gain, order of loop filter, operating frequency of VCO and supply voltage.

Table I: Comparison of different VCO quantizer for ΣΔ ADC

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Tech. (nm)</th>
<th>Operating Frequency of VCO (MHz)</th>
<th>VCO Power (mW)</th>
<th>Gain (dB)</th>
<th>Phase margin (degree)</th>
<th>Supply voltage (V)</th>
<th>Order of loop filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>[3]</td>
<td>0.090</td>
<td>0.1 – 4</td>
<td>1.3</td>
<td>58</td>
<td>55</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>[4]</td>
<td>0.18</td>
<td>2.5</td>
<td>3</td>
<td>40</td>
<td>70</td>
<td>1.8</td>
<td>4</td>
</tr>
<tr>
<td>[6]</td>
<td>0.18</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.8</td>
<td>-</td>
</tr>
<tr>
<td>[7]</td>
<td>0.13</td>
<td>225</td>
<td>18</td>
<td>63</td>
<td>55</td>
<td>1.5</td>
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<tr>
<td>[8]</td>
<td>0.13</td>
<td>10</td>
<td>20</td>
<td>50</td>
<td>-</td>
<td>1.2</td>
<td>-</td>
</tr>
<tr>
<td>[9]</td>
<td>0.13</td>
<td>640</td>
<td>20.18</td>
<td>-</td>
<td>-</td>
<td>1.2</td>
<td>3</td>
</tr>
<tr>
<td>This work</td>
<td>0.18</td>
<td>3.418</td>
<td>2.57</td>
<td>61.51</td>
<td>69.73</td>
<td>1.8</td>
<td>4</td>
</tr>
</tbody>
</table>

Conclusion

It is observed from results obtained that LRFF based 1 bit quantizer used in VCO enabled quantizer consumes less power. Active RC integrator based loop filter provides high linearity and has greater ease of design. OP AMP installed in loop filter has an open loop gain of 61.51dB and phase margin of 69.73degrees. Compared to previous work done on the Σ-Δ ADC utilizing VCO enabled quantizer this work not only gives higher noise rejection ability but also consumes less power of 2.57mW with 14.3% less than previous work.

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References


Wind Energy System Coupled with Bidirectional Quasi Z-Source Inverter for Motor applications

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Abstract

A Bidirectional Quasi-Z-supply Inverter (BQZSI), using a controllable shoot-through insertion in running permanent magnet synchronous motor is proposed. This BQZSI is simple and exerts a direct control over the wind energy. In addition, this improves the efficiency of the voltage gain and reduces the total harmonic distortion. The Voltage Source Inverter (VSI) is used for Adjustable Speed Drives (ASD). The VSI normally calls for an additional boost converter. This supplementary converter will in turn, increase the cost and design complexity lowering the performance of the power conversion devices. Additionally, the voltage drop will disrupt the conventional ASD systems, thereby shutting down the crucial loads and procedures. Hypothetically, the three sources - the unique Z-source, Quasi-Z-source, and embedded Z-source have limitless voltage gain. For every additional shoot through state, the commutation time of the semiconductor switches increases which proportionately increase the switching losses. Therefore, to prevent the switching loss, appropriate placing of the shoot-through condition in the switching cycle becomes essential. To rectify this, an amalgamation of BQZSI with a method of maximum constant boost control procedure is proposed. This can be achieved with the help of voltage-driven quasi-Z-source inverter with continuous conduction mode that is carried out at the input of the converter which will enhance the input voltage by making use of the more switching states with the help of shoot-through state insertion method. By using BQZSI, it is possible to handle the energy on both the sides and hence can be used with tiny movements on both the directions. This bidirectional converter will improve the performance of the Permanent Magnet Synchronous Motor drive.

Keywords: Bidirectional quasi-Z-source inverter (BQZSI), adjustable speed drives system application, PMSM.

Introduction

The power converters for ASD applications consist of VSI, current source inverters (CSI) and Z-source inverters (ZSI). It is a well-known fact that the traditional voltage source inverter and current source inverter have their characteristic drawbacks. Hence, the input voltage of the traditional voltage source inverter must be greater than the peak AC output voltage. In other words, the input voltage of the traditional current source inverter must be lower than the peak AC output voltage. The electromagnetic interference in them, often cause the damage of the power semi-conductor devices of the power supply.

A single-stage booster/buck inverter is popularly known as the Z-source inverter (ZSI). Without more switching devices, its impedance network is possible as it couples the main circuit inverter to the DC supply. The voltage boost feature allows the energy to be stored during the shoot-through period and release the same during the non-shoot through period. Voltage boost methods conforming to Pulse Width Modulation (PWM) have been analyzed under various control systems like simple boost control, maximum constant boost control and maximum boost control. Due to its single stage voltage buck/booster property, the impedance inverter ensures a wider range that is made possible by a two stage DC-DC and DC-AC converter structures. The impedance inverter has gained wide popularity because...
it is economical and reliable. An advanced type of quasi Z source has been used in running the Permanent Magnet Synchronous Motor \(^{[14]}\) by including the state-space average, dynamic model and a transient analysis of Z source network.

**BI-DIRECTIONAL QUASI Z SOURCE NETWORK**

The conventional general purpose motor drive system or the ASD system is based on the VSI which has a diode rectifier, capacitor and an Inverter Bridge as represented in Fig 1. It has a capacitor on the AC side and a unique LC network on the DC side. By managing the shoot-through cycle, any desired AC voltage output can be produced by the Z-source inverter. It can also minimize the line harmonics and improve the power factor and reliability giving out ride-through capability during voltage sags.\(^{[1]} - [3]\).

A dedicated voltage controller with inductor current controller is designed to reject the disturbance of the intermittent wind based electrical power output voltage. This also stabilizes the dc-link voltage during a non-shoot through state which is termed as Bidirectional quasi-Z-source inverter. Fig.1 shows the circuit diagram of BQZSI.

![Fig.1. Bi-directional q-ZSI](image)

**Operation Principle**

The Bidirectional quasi-Z-source Inverter overcomes the limitations of conventional QZSIs. This new design simplifies the controller design and has an advantage of operating in wide-range of load even on no load with the smaller inductors which eliminates the probability of voltage drop in the DC-link. Its design is simplified to operate in wide range of loads and even on smaller inductors that eliminate the probability of voltage drop in the DC link. The topology of the BQZSI is shown in Fig 1. The BQZSI inter relation is shown in Fig 1. It has two functional parts: 1) the QZSN, which is composed of Q1, Q2, Q1, Q2 and Q1 and 2) the three-phase bridge. Compared to the conventional QZSI, the diode in the QZSN is replaced by an active switch Q1 with a parallel diode. The bidirectional power flow is made possible by appropriate control of this switch. The BQZSI has three operation states: the active state, the zero state, and the shoot-through state \(^{[2]} [33]\).

**Switching Pattern of Q1**

During the generation of energy, the switching pattern Q1 is complementary to the shoot-through pattern of the three-phase bridge. The switch Q1 is opened as and when the three-phase bridge is in the shoot-through state. The body diode D is reversely blocked and the voltage boost function is made possible. The switch Q1 is closed as and when the three-phase bridge is in the non-shoot-through state. The reverse current goes through the switch Q1 sending the energy back to the DC source. For safety purposes, appropriate ‘Dead Time’ should be initiated between the control signals of the shoot-through state and Q1. Otherwise, the two capacitors in the circuit will result in short-connection through Q1, causing damage to the devices connected. The modes of operation are described below:
Modes of Operation of BQZSI

Mode 1: The BQZSI operating in the shoot-through state. Q1 is open, and the diode D is reversely blocked because $v_{c1} + v_{c2}$. The currents in the inductors decrease sharply and charge up the capacitors, as shown in Fig. 2(a). If the shoot-through state is long enough, there is a possibility that the currents in the inductors change the direction and the capacitors begin to charge energy back to the inductors, as shown in Fig. 2(b).

Mode 2: If at the end of Mode 1, the inductor currents have a positive direction, the BQZSI will go to Mode 2 as shown in Fig. 2(c). Otherwise, it will straight away go to Mode 7. In Mode 2, the BQZSI is in the zero state and Q1 is closed. There is current flowing through the parallel-connected diode D of Q1. The inductor currents are in the positive direction and start to decrease, while the capacitor voltages are charged up.

Mode 3: The BQZSI is switched to the active state as shown in Fig. 2(d). The currents in the inductors are still in the positive direction and continue to decrease. The voltages of the capacitors are continuously charged up.

Mode 4: The BQZSI will remain in Mode 3 until the currents in the inductors decrease to zero and change the direction. Then, the circuit will operate in Mode 4, where, the inductor currents increase reversely, and the capacitor voltages are charged up by the AC side active power as shown in Fig. 2(e).

Mode 5: The BQZSI begins to operate in Mode 5 when, $I_L < 0$, $I_{Lp} / 2 < I_L < I_{pN}$. In this Mode, the inductor currents and capacitor voltages follow the same pattern as in Mode 4, but the current in Q1 changes the direction as shown in Fig. 2(f).

Mode 6: The BQZSI is in Mode 6 when, $I_L < 0$, $I_L > I_{pN}$. In this Mode, the capacitor voltages begin to drop, and the inductor currents continue to increase as shown in Fig. 2(g).

Mode 7: The BQZSI is again in the zero state. As shown in Fig. 2(h), the capacitors continue to discharge.
and the current in the inductors increase. One possible waveform of the inductor current and capacitor voltage in one switching cycle where $T_{st}$ stands for the shoot-through state, $T_{z}$ stands for the zero state, and $T_{a}$ stands for the active state. Depending on the real operation condition, the BQZSI will work with different combinations and sequences of the current modes.

![Fig.2.(h) Mode 7](image)

*PWM signal generation of the active switch*

The aim of the modulation method is to improve the voltage gain and decrease the Total-Harmonic-Distortion (THD). The difference between BQZS inverter and conventional voltage source inverter in the method of inserting shoot-through time period influences the design and efficiency of the inverters. One of the unique characteristics of BQZSI is the variation of AC-voltage between 0 to $\infty$ without considering the input DC-voltage. A modified PWM method called simple boost control method\(^\text{[27]}\) uses two straight lines to control the shoot-through states. But in this control method, the voltage stress across the switches will be quite high. Due to the limitation of device voltage rating, the obtainable voltage gain is restricted. A maximum boost control method\(^\text{[29]}\), the BQZSI provides a boosted output voltage that is greater than the input voltage. This method is also capable of reducing the voltage stress across the switches. But it produces low frequency current ripple. In order to get an optimum design of BQZSI, the current ripple should be eliminated by maintaining a constant shoot through duty ratio. Also, the voltage boost should be high in order to reduce the voltage stress across the switches.

Third harmonic injection is generally used in a three-phase inverter system to increase the modulation index[M] and to increase system voltage gain. There are around five modulation curves: There are three reference signals namely, $V_c$, and two shoot-through envelope signals $V_{p}$ and $V_{n}$. When the triangle carrier wave signal is higher than the upper shoot-through $V_{p}$ or lower than the bottom shoot-through $V_c$, the inverter is turned to a shoot-through zero condition. In between this, the inverter switches work in the same way as that of the traditional carrier based PWM control. Here the BQZSI with third harmonic injected maximum constant boost control is introduced.

The duty ratio, voltage gain, boost factor and the third harmonic injected constant boost control method are similar to the maximum constant boost control method. The difference is that the introduced control method has a larger modulation index M, which increases from 1 to $2/\sqrt{3}$. The third harmonic PWM utilizes the DC supply voltage better than the sinusoidal PWM.

**Simulation Results**

For the purpose of analysis, BQZSI operating in Continuous Conduction Mode is simulated and designed for input supply of wind energy output of 230 V with a switching frequency of 10 kHz and a carrier frequency of 5 kHz. The simulation of BQZSI with Permanent Magnet Synchronous Motor load is carried out. The simulation diagram and waveforms are given below.

For the analysis of BQZSI 3-phase 4 pole, Permanent Magnet Synchronous Motor of 415 V, 1.6 A, 1500 rpm is used as shown in Fig.3. The PMSM parameters used for the simulation are tabulated as follows.

**TABLE 1 : SIMULATION PARAMETERS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Design Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Diode Rectifier Resistance</td>
<td>0.001 $\Omega$.</td>
</tr>
<tr>
<td>BQZ-source Network: L$_1$ = L$_2$</td>
<td>12 m H</td>
</tr>
<tr>
<td>BQZ-source Network: C$_1$ = C$_2$</td>
<td>27000 $\mu$F</td>
</tr>
<tr>
<td>PMSM Motor Resistance/phase</td>
<td>2.895 $\Omega$</td>
</tr>
<tr>
<td>PMSM Motor Inductance/phase</td>
<td>8.7e$^{-3}$ H.</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>10 kHz</td>
</tr>
</tbody>
</table>
Third harmonic injected maximum constant boost control is used to generate the gate signal for BQZSI. The triangular wave for PWM generation is compared with third harmonic injected sine wave. For shoot through insertion, the triangular wave is compared with two straight lines $V_p$ and $V$. Gate signal for switch Q1 is complimentary to the shoot through gate signal.
When input DC voltage of 306V is applied, the DC link voltage is boosted to two times the input DC supply. The corresponding AC voltage and current are obtained across the load terminal. The result shows that there is no distortion on the DC-link voltage and the voltage across the switch Q1, which indicates that there is no discontinuous current in the inductors and the switch. Therefore, the system is working in the continuous conduction mode (CCM). Figures 5 and 6 show the output three phase load voltage and current respectively.
Fig. 7 and Fig. 8 show the Permanent Magnet Synchronous Motor, speed and torque respectively, which are obtained around the rated value.

CONCLUSION

A deep analysis of different types of Z source topologies help to find out the need for the parameters to be improved like, efficiency, increasing the voltage gain, reducing the voltage stress across the switching devices and proper utilization of the input voltage in order to get maximum output voltage. The analysis reveals that with Bi-directional Quasi Z source network with an active semiconductor switch, the reverse flow of power can be realized with the QZSI along with running Permanent Magnet Synchronous Motor which has a better operating condition by avoiding Discontinuous conduction Mode. Voltage stress across the switching devices is reduced by using maximum constant boost control and the inverter performance is improved.

Ethical Clearance - Not required

Source of Funding - Self

Conflict of Interest - Nil

REFERENCES


Stemness of Pulp Cells From Supplemental Tooth During the Extended Culture

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Abstract

Background/Objectives: The aim of this study was to evaluate the potential of stemness of the human dental pulp cells from supplemental tooth during the extended culture.

Methods/Statistical analysis: Supplemental tooth was collected from a patient who was 5-year-old and soon after extraction of the tooth, the primary cells were cultured from the pulp tissues. Those were subcultured until 16th passage and each passage cells were evaluated their stemness with expression of cell surface markers by using flow cytometric analysis.

Findings: The cell surface markers which are representative mesenchymal stem cell markers, such as CD44, CD73, CD90 and CD146 were expressed during the whole passages. The expression of these markers showed second peak at 6 - 7 passages and slightly decreased after 8th passage during the extended culture of dental pulp cells from this supplemental tooth. In addition, those cells were confirmed with negative expressions of CD24, CD146 markers. The proliferation rate of stem cells from the pulp of supplemental tooth was two to three times fast comparing to the stem cells from other dental pulp tissue.

Improvements/Applications: Pulp tissue in supplemental tooth could be a choice for donor site of stem cells since it was confirmed that they possessed stemness, especially strong in early passages.

Keywords: Stem cells, Supernumerary tooth, Supplemental tooth, Flow cytometry, Extended culture

Introduction

Based on that the need for tissue engineering and regenerative medicine has extensively been increased, many researchers’ studies have focused on the adult stem cells, because it is relatively less unethical and easier for adult stem cells to get than embryonic stem cells¹⁻³.

Mesenchymal stem cells (MSCs) can be acquired from several tissues, such as bone marrow, umbilical cords, adipose tissues, and dental tissues⁴⁻⁶. The sources of adult stem cell from dental teeth were reported from wisdom tooth, deciduous tooth, and supernumerary tooth⁷⁻⁹. Furthermore, those teeth would be subdivided into several part of the teeth such as pulp tissue, periodontal ligament, dental sac, and apical follicle for the resources of stem cells¹⁰⁻¹². Dental pulp and peripheral tissues of tooth have been known as treasure boxes to obtain stem cells, which contain the stemness potentials for differentiation into various tissues including bone, ligament, nerve, vessels as well as dentin⁷⁻⁸. In spite of their unusual features in developmental formation, they are characterized by the same form and function in comparison to adjacent teeth and have no anatomical differences¹³. Supernumerary tooth is one of types of the supernumerary teeth¹³.

So far, few cases of supplemental maxillary central incisors have been described in the literature. Impacted supernumerary tooth can be extracted in an aseptic and scheduled condition, and thus it would be beneficial to culture them as stem cell resources. Here, we collected
supplemental tooth from 5-year-old patient, and evaluate the potential of stem cells cultured from pulp tissue of them during the extended culture, suggesting the optimal condition to obtain the stem cells from these teeth.

**Materials and Method**

**cell culture**

The collection process of the tooth sample from a patient was approved by the IRB of the Dankook dental hospital. The tooth was obtained from a healthy 5-year-old child who visited the pediatric dental clinic in dental hospital of Dankook university to extract a supernumerary tooth. The exact location of supplemental tooth inside the maxillary bone was confirmed by the cone beam computed tomography image before surgery.

After extracting the supplemental tooth, it was immersed immediately in α-MEM media (GIBCO LifeTechnologies, Grand Island, N.Y., USA) contained 20% fetal bovine serum (lot no. DVC0359, Hyclone) and antibiotics. The crown portion of the extracted tooth was cut around at the level of cemento-enamel junction to take out the pulp tissue under sterile condition. Pulp tissue inside the pulp chamber and pulp canal was collected with barbed broach files and tweezers. Enzymatic digestion method was used to separate cells from the pulp tissue. The pulp tissue was cut into several small segments and put in the culture dishes containing 3 mg/mL Type I collagenase (Sigma-Aldrich Co., St. Louis, MO, USA) and 4 mg/mL Dispase (Sigma-Aldrich Co., St. Louis, MO, USA). The dishes laid in shaking incubator at 37°C for 1 hr. Thereafter, to get separated single cells those were filtered out the 70μm Falcon strainer and then incubated in the incubator at 37°C for 7 days. The media was changed every 2-3 days and suspended cells were washed out with Trypsin-EDTA (CORNING Inc, NY, USA). When the cells had grown to 80% confluency in the culture dish, those cells were subcultured at one fifth dilution for later passage. The same subculture was performed until 16 passages.

**Immunotyping by Flow Cytometric Analysis**

1.0×10⁴ cells of each passage were resuspended in 100μg of staining buffer and incubated with 1 μg/ml of antibody for 1 hour at 4°C in the dark. Cell suspensions were washed twice with phosphate buffered saline containing 10% FBS. The following antibodies labeled with FITC(fluorescein isothiocyanate) were used: CD24, CD44, CD90, CD106, CD146. An anti-human IgG was used for negative control.

For immunophenotyping of the human pulp stem cells from supplemental tooth, flow cytometric analysis was achieved with FACSCaliburTM Flow Cytometer (BD Biosciences, San Jose, Calif, USA).

CellQuest software and WinMDI program were used to acquire mean value of florescence.

**Results and Discussion**

The expression of mesenchymal stem cell markers was observed through flow cytometry analysis. The surface markers such as CD24 and CD106 were negative, whereas CD44, 73, 90 and 146 were positive[Fig1]. Expressions of positive markers were showed in all passages which meant the cells contained stemness even after several times of subcultures. Three markers which showed positive expressions had a certain similar pattern during subculture[Fig 2]. The pattern was shown as deceasing mean fluorescence little by little at 1-5 passages before increasing sharply in the 6-7 passages. After the second peak at 7th passage, it decreased again.

Even though the florescence extent of stem cells in latter passages were slightly decreased comparing with early passages, latter passages cells were also confirmed to have stemness by expressing positive result in mesenchymal stem cell marker detection. The markers with negative expressions that confirmed the cells as not hematopoietic lineage showed consistent result during whole passages[Fig 3]. CD24 is a marker known as a detector of β -lymphocytes and differentiating neuroblasts. In addition, CD106 is a marker of endothelial cells rather than MSCs. Both markers were negative in this study.
control (filled curved with red color). Fluorescent intensity was analyzed with FACS. The FACS result from 1st to 8th passage. CD44, CD73, CD90 and CD146 were positive during all passages, and CD24 and CD106 were negative through the all passages. The red color dotted line in the CD44, CD73, CD90 and CD146 means the highest level of that antibodies. (FACS: fluorescence-activated cell sorting, sDPSCs: human dental pulp stem cells from supplemental tooth, CD; cluster of designation)

Figure 2. Positive CD Markers. Positive CD Markers have a pattern to match each other. While cultivating up to 16 passages, the increased values of 7 passage was shown and then decreased again.

Figure 3. Negative CD Markers. Negative CD Markers have a pattern to match each other. As an example of positive markers, regression analysis of subculture and mean fluorescence of CD44 is shown at Fig4. During the 16th passages, CD44 represented a linear regression, showing \( y = -9.8385x + 230.98 \) and \( R^2 = 0.2155 \).

Figure 4. During the 16th passages, CD44 represented a linear regression, showing \( y = -9.8385x + 230.98 \) and \( R^2 = 0.2155 \).

‘Stem Cells’ was noted in 1956 with an announcement of the experiment that bone marrow of healthy mouse was transplanted to terminally ill mouse’s blood circulatory system that had destroyed by radiation\textsuperscript{15}. In 1981, Evans et al.\textsuperscript{1} succeeded to obtain embryonic stem cells of rats, since then, the research about stem cells which might have unlimited self-renewal capacity and the totipotentiality that could differentiate into several types of subclassification cells have been underway in earnest.

Stem cell is a cell that could continuously produce not only unaltered daughter cells but also altered daughter cells with different restricted properties\textsuperscript{16}. Stem cells can be categorized into embryonic stem cells and adult stem cells depending on the source\textsuperscript{17}. Embryonic stem cells are obtained in embryo development stage, so there are ethical controversies. Adult stem cells are undifferentiated cells in each tissue of the body after development. Many researches has been reported the sources of stem cells from varies part of bodies including bone marrow, umbilical cord blood, periosteum, pancreas, fat, muscle, blood, hair follicles, skin and dental tissues\textsuperscript{1-3}. Most of the body parts have a certain degree of tissue regeneration capability to repair or regenerate each organ of the bodies after injuries, and adult stem cells exist for this reason. Adult stem cells are attracting attention from researchers because they are quite free from ethical and religious matters.

In the process of obtaining adult stem cells in various tissues, it was difficult to avoid unnecessary damage to bodily tissue of donor. Stem cells from the teeth could be good choices if the teeth which need to be extracted for other reasons may be utilized instead of discard. Even though donors are grown up they have undifferentiated dental tissues possessing stem cells with multipotency\textsuperscript{6,18}. Extraction of wisdom teeth or supernumerary teeth are usually planned to prevent health problems, which could provide a good advantage of obtaining stem cells without additional damaging procedures to the normal tissues. It was reported that adult dental stem cells derived from wisdom teeth had relatively lower differentiation potential than those from supernumerary teeth\textsuperscript{6}. The mean age of patients who need extraction of supernumerary teeth are usually younger than those who need to extract wisdom teeth, and it may explain differences of stem cell characteristics between them.

Supernumerary teeth are additional to the normal series of teeth that can cause delayed eruption of adjacent teeth, malocclusion (rotation, displacement and diastema) and dentigerous cyst formation. Therefore, relatively early age extraction is recommended\textsuperscript{19}. 
Primosch\textsuperscript{13} classified supernumerary tooth into two types according to the morphology. One is supplemental tooth that has normal shape and size (eumorphic) and the other is rudimentary tooth that has abnormal shape and smaller size (dysmorphic). The rudimentary tooth includes ‘conical’, ‘tuberculate’ and ‘molariform’ tooth. These two types of supernumerary tooth have different origination theory. A rudimentary form may develop from the epithelial remnants of the dental lamina while a supplemental form may develop from the lingual extension of an accessory tooth bud.

Recently, as the demand for tissue engineering and tissue regeneration has been increasing, attention to adult stem cells, especially, to mesenchymal stem cells has been standing out. To find out the mesenchymal stem cells from others, there were several laboratory examinations and flow cytometry analysis method is known as a very effective method. Flow cytometry method is duplicable, reliable and relatively easy to apply\textsuperscript{20}. Because it could detect extracellular vesicles by measuring intensity of fluorescence it is possible to estimate unknown cells’ characteristics\textsuperscript{21}.

Mesenchymal stem cells have several special characteristics\textsuperscript{22}. First, they could attach to the plastic culture plate surface under a common culture conditions. In addition, they show positive expression of specific markers including CD90, CD105, CD73 while negative to CD45, CD34, CD14, CD79. Mesenchymal stem cells have differentiation potential into osteocytes, adipocytes, chondrocytes etc. in a specific differentiation medium conditions\textsuperscript{23,24,25}. CD44, CD73, and CD90 markers by convention flow cytometry can be important indicators for distinguishing fibroblast from MSC\textsuperscript{20}.

However, additional study regarding the research condition is needed. Because the results could be various according to the research conditions like method of primary culture, antibiotics, etc.

The term to succeeding a passage was only 2-3 days in this study. It is much shorter than the previous study using impacted third molar which needed 7 - 10 days\textsuperscript{14}. The results indicated that human dental pulp stem cells from supplemental tooth (sDPSCs) had strong proliferative potential than stem cells of third molar.

This study was planned to investigate the availability of supplemental tooth as a donor site of adult stem cells. In addition, cells from each passage during subculture were estimated to find an optimum passage that could provide as many stem cells as possible for more efficient use of donor tissue.

In this study, sDPSCs were cultured up to 16th passage and observed mesenchymal stem cell marker, such as, CD24, CD106, CD44, CD73, CD90, and CD146 were observed through the passage. It was confirmed that pulp tissue of supplemental tooth contained stem cells with superior aspects, so those teeth could be regarded as good donors for stem cell research.

**Conclusion**

Stem cells from pulp of supplemental tooth showed potential of stemness during subculture till 16 passage. Flow cytometry analysis result showed decrease during later passage from primary culture but expression of positive cell markers had the second peak at 6-7 passages which meant stem cells before 8 passage could be more valuable as a donor than the cells after 8th passage. Overall results of this study showed that pulp tissue in supplemental tooth could be used as adult stem cell donor site since it was confirmed to show characteristics of stem cells by flow cytometry analysis with mesenchymal stem cell makers during extended culture.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** - Nil

**References**


What Makes it Hard for Caregivers of Stroke Patients for Preventing Dysphagia? In terms of Burden, Knowledge, and Attitude

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Abstract

Background/Objectives: The objectives of this study were to identify the levels of the caregiver burden, the knowledge of dysphagia management, and the attitude toward aspiration prevention of stroke patients’ caregivers.

Methods/Statistical Analysis: The subjects of this study were 83 caregivers of stroke patients, who were hospitalized in general hospitals in Seoul and Incheon. The sociodemographic and individual factors related to the dysphagia knowledge of a caregiver was explored by using multivariate regression analysis.

Findings: The mean score of total burden was 3.83 points out of 5 points. The mean burden of ‘financial status’ was the highest. The results of the knowledge of dysphagia management of stroke patients’ caregivers showed that the mean score was 23.7±7.2: caregiver (22.4 ± 8.5), spouses (20.1 ± 8.1) and children (17.3 ± 4.3). The mean score of the attitude for preventing aspiration toward the dysphagia management of stroke patients’ caregivers was 24.1±6.8: in the order of caregivers (23.2±8.1), spouses (21.7±7.5), and children (18.8 ± 5.2). The results of multivariate regression analysis indicated that the dysphagia knowledge of caregivers was associated with gender(Exp(B)=1.31), age(Exp(B)=4.35), education level (Exp(B)=8.62), and the relationship with a patient (Exp(B)=5.31) even after adjusting all confounding factors.

Improvements/Applications: The results of this study showed that the main caregiver of a stroke patient suffered from the severe burden and did not have enough knowledge for the dysphagia management and aspiration pneumonia prevention.

Keywords: Knowledge, swallowing disorder, dysphagia, caregiver, Health Belief Model, speech language pathology

Introduction

Although the average life expectancy has increased due to the advancement of science and technology, longevity does not necessarily mean an extension of healthy life. Previous studies have reported that, as of 2015, the life expectancy of South Korea is 82.1 years and the disability adjusted life expectancy is 73.2 years, indicating that people are likely to suffer from illness during the last ten years of life 1. Particularly, eight out of ten elderly people would have one or more chronic diseases, showing that the elderly group is in a vulnerable health condition 1. Therefore, it is important to gain the knowledge of diseases and practice healthy behaviors for healthy aging.

Particularly, the stroke is one of the geriatric diseases that occurs mainly in old age and accompanies by many stress disorder types depending on the damaged area of the brain. These stress disorders include various motor function disorders such as paralysis, dysphagia, dysesthesia, speech dysfunction, and emotional disorder 2. Among them, dysphagia is defined as the issues associated with swallowing 3. The swallowing process consists of an oral preparatory phase, an oral phase, a Pharyngeal phase, and an esophageal phase. The oral
preparation phase chews food to generate a bolus. The oral phase delivers the bolus to the anterior faucial arch, where the swallowing reflex occurs. In the Pharyngeal phase, food arrives at the esophagus through the pharynx due to the swallowing reflex. Moreover, the food goes to the stomach through the esophagus in the esophageal phase. The dysphagia occurs if there is an issue in any of these four steps. It is known that various factors (e.g., stroke, dementia, Parkinson’s disease, malignant tumor, and gastroesophageal reflux disease) can cause the dysphagia and it is one of the most common disorders of patients who seek a rehabilitation medical treatment.

If the dysphagia persists, it can cause serious health problems such as malnutrition and weight loss. Moreover, it can cause complications such as aspiration pneumonia. Therefore, it can cause death or exacerbate the symptoms to extend the hospitalization duration or increase the treatment cost. Additionally, the onset of dysphagia in the old age can lead to eating anxiety so it can affect the mental health and the quality of life as well as the physical health. Therefore, it is very important to detect, rehabilitate, and prevent dysphagia as soon as possible for having a successful old age.

The lifetime prevalence of dysphagia among the elderly South Korean is 17.1%, which is approximately one out of five elderly people. It is more frequent than in other countries such as the UK (11.4%), Australia(16%), and Japan (13.8%)\(^5\). Nonetheless, the elderly living in their homes in a local community are not well aware of the dysphagia, unlike hospitalized patients. Moreover, even if the dysphagia occurs, they tend to consider it as one of the aging symptoms\(^5\). Therefore, only a small proportion of patients receive appropriate evaluation and treatment\(^5\).

The elderly with stroke are vulnerable to the dysphagia\(^9\). Therefore, it is possible to minimize problems associated with swallowing such as absorption and reduce the unnecessary medical expenses when a high-risk group is identified in the early stage and appropriate prevention and management are given\(^9\). Nevertheless, most previous studies on dysphagia have focused on assessing the effects of treatments on patients with dysphagia\(^10\)\(^-\)\(^14\). Moreover, only a few studies have evaluated the knowledge and preventative activities related to dysphagia of caregivers who supports stroke patients.

Considering that stroke is one of the chronic diseases that result in many disabilities, stroke patients need a help of someone for maintaining daily life and providing basic nursing\(^15\). In most cases, the family takes a responsibility\(^15\). When a stroke occurs and a patient is hospitalized all of a sudden, a caregiver cannot respond to the condition of the patient effectively because the caregiver does not have enough knowledge about the disease and is not well aware of the disease. Moreover, there are compensation strategies (e.g., posture change, bolus control, and dietary control) for managing patients with dysphagia. It is highly likely that ordinary people are not familiar with these professional management strategies. It is necessary to identify the knowledge level of the dysphagia management for caregivers in order to provide baseline data for developing and implementing a dysphagia specialized management and education program.

The health belief model argues that subjective knowledge determines a person’s behavior\(^16\). An appropriate health behavior is likely to be induced when health knowledge and appropriate motivation are combined\(^16\). Moreover, according to KAP (Knowledge, Attitude, and Practice) based on pedagogical learning theory, positive attitude and correct knowledge must be preceded in order to induce an appropriate health behavior\(^17\). Most of all, the onset rate of stroke is not only high in the elderly population but also accompanies various stress disorders in multiple levels. Therefore, the stroke requires continuous and steady care for preventing recurrence.

In summary, the prevention is most important for lowering the incidence of stroke-induced dysphagia. Therefore, the caregivers of stroke patients are required to have knowledge for precisely assessing the dysphagia associated problems of stroke patients and practice strategies for preventing aspiration pneumonia.

The objectives of this study were to identify the levels of the caregiver burden, the knowledge of dysphagia management, and the attitude toward aspiration prevention of stroke patients’ caregivers and provide the baseline data for managing the dysphagia.

**Materials and Method**

**Study Subjects**

It was a survey research conducted to identify the
knowledge, preventative attitude, and practice of stroke patients’ caregivers and confirm associated factors. The subjects of this study were 83 caregivers of stroke patients, who were hospitalized in general hospitals in Seoul and Incheon. When it was assumed to need nine predictors, the power (1-\(B^2\)) of 0.8, and the effective size (\(f^2\)) of 0.2 at the significance level of alpha=0.5, the required minimum sample size was estimated 78 subjects. On the assumption of 70% recovery rate, the questionnaires were distributed to 115 people. Three hospitals and two geriatric nursing hospitals in Seoul and Incheon were randomly selected for data collection. The study was approved after explaining the objectives and methods of this study to the officials of these medical institutions. The objective of this study, anonymity policy, and withdrawal possibility was explained to each subject and they consented to participate in the study in writing. The structured questionnaires were distributed to the subjects between Oct 7 and Nov 30, 2016, and study participants filled in the questionnaire in the self-report type. The 83 questionnaires were collected out of 115 copies, and the recovery rate was 72.2%.

**Measurement**

**Caregiver Burden of Stroke Patients’ Caregivers:** The burden of stroke patients’ caregivers was measured by the tool regarding the burden of stroke patients’ family developed by Kim & No (2005)\(^\text{18}\) after revising it suitable to the study. The tool is composed of 24 items encompassing seven domains: ten items of social activities, six items of family support system, two items of a patient’s future, two items of a caregiver’s future, one item of financial status, one item of patient’s dependency, and two items of physical health. Each item was assessed by five-point scale: 1 = “strongly disagree”; 2 = “disagree”; 3 = “not agree or disagree”; 4 = “agree”; and 5 = “strongly agree”. The minimum and maximum burden scores were 24 and 120, respectively. The higher score means the higher burden. The Cronbach’s \(\alpha\) coefficient of this study was .921.

**Knowledge on Dysphagia Management of Stroke Patient’s Caregivers:** The caregivers’ knowledge on dysphagia management was evaluated by using the questionnaire developed by Song & Park \(^\text{19}\). This questionnaire consisted of ten items in the four-point scale (i.e., 1 = “I do not know it at all”, 2 = “I do not know it well”, 3 = “I know it well”, and 4 = I know it very well”). They cover positions during eating, the methods of stimulating senses, oral exercise, how to use viscosity thickeners, ways to cope with emergencies, dietary control, how to use maneuver, and the maintenance of nasogastric tube (NG tube). The full score was 40 and the higher score means better knowledge for managing dysphagia. The Cronbach’s \(\alpha\) coefficient of the study was .830.

**Attitude for Preventing Aspiration Pneumonia due to Dysphagia:** The tool for preventing the aspiration pneumonia of the elderly developed by Kim & Kim (2012) \(^\text{\text{20}}\) was used to evaluate the attitude to prevent the aspiration pneumonia due to dysphagia. This tool is composed of 17 items (i.e., four items of benefit domain, six items of perceived disability domain, and seven items of perceived self-efficacy domain) based on the perceived benefit, perceived disability, and perceived self-efficacy among factors identified as the motivation of behaviors in the health promotion model developed by Pender (1996) \(^\text{\text{21}}\). Each item was measured by a 4-point Likert scale: 4 = “strongly agree”, 3 = “agree”, 2 = “disagree”, and 1 = “strongly disagree”. The score ranges from 17 to 68 points. The higher score means the more positive attitude for preventing the aspiration pneumonia. The reliability of this tool (Cronbach’s \(\alpha\)) was 0.811.

**Statistical Analysis**

The data were analyzed as follows. First, the general characteristics of the subjects were analyzed by calculating percentage, mean, and standard deviation. Second, mean and standard deviation were calculated for the subject’s burden of caring a stroke patient, the knowledge for managing dysphagia, and the attitude for preventing the aspiration pneumonia due to dysphagia. Third, the sociodemographic and individual factors related to the dysphagia knowledge of a caregiver was explored by using multivariate regression analysis. All analyses were conducted using IBM SPSS version 24.0 (IBM Inc., Chicago, Illinois) and all statistical significance was determined at alpha = .05.

**Results**

**General Characteristics of Subjects:**

The general characteristics of subjects (n=83), caring stroke patients, are shown in Table 1. Gender of subjects was 20.2% of male (n=17) and 78.8% of female (n=66). The age distribution of the subjects was 20-29
years (5.7%; n=5), 30-39 years (4.3%; n=4), 40-49 years (12.9%; n=10), and over 50 years (7.1%; n=64). The education level was 9.3% (n=8) for elementary school graduates, 22.3% (n=19) for middle school graduates, 50.4% (n=41) for high school graduates, and 18% (n=15) for college graduate and above. The subjective health condition was 8.6% (n=7) for very good, 60.0% (n=50) for good, 25.7% (n=21) for bad, and 5.7% (n=5) for very bad. The 10.0% (n=8) of the subjects had an illness and the 90.0% (n=75) of them did not have an illness. The relationship of the patient was 28.5% (n=24) for spouses, 12.9% (n=11) for children, 55.7% (n=46) for paid caregivers, and 2.9% (n=2) for others. The feeding method of the patient was 45.5% (n=38) for mouth, 20.8% (n=17) for nasogastric tube, 32.6% (n=27) for gastrostomy tube, and 1.1% (n=1) for others. The total care time was 39.7% (n=33) for less than one year, 25.3% (n=21) for between one and two years, 20.2% (n=17) for between two and three years, and 14.5% (n=12) for three and more years. The care time per day was 5.5% (n=5) for 0-7 hours, 14.5% (n=12) for 7-12 hours, 31.2% (n=26) for 12-19 hours, and 48.8% (n=40) for 19-24 hours.

Caregiver Burden of Stroke Patients’ Caregivers

The caregiver burden of stroke patients’ caregivers is presented in Table 2 and 3. The mean score of total burden was 3.83 points out of 5 points. The mean burden of ‘financial status’ was the highest (4.12), followed by ‘a patient dependency (3.88)’ and ‘a patient’s future (3.83)’ [Table 2]. Among the items, “I am worried about the prognosis of the patient” was 4.30 (mean), which was the highest among the caregiver burden 24 items [Table 3].

Knowledge of Dysphagia Management and Attitudes for Preventing Aspiration of Caregivers of Stroke Patients

The results of the knowledge of dysphagia management of stroke patients’ caregivers showed that the mean score was 23.7±7.2: caregiver (22.4 ± 8.5), spouses (20.1 ± 8.1) and children (17.3 ± 4.3). In terms of sub-domains, the mean score of the treatment and prevention domain was 4.31 ± 0.78, that of the concept and risk domain was 1.63 ± 0.58, and that of the symptoms of aspiration pneumonia and diagnosis domain was 2.17 ± 0.50. The percentage of correct answers for each item was the highest (88.5%) for “Maintaining the sitting position for at least 30 minutes after the meal helps a patient prevent aspiration” and the lowest (38.1%) for “keeping NG tube increases the possibility of aspiration pneumonia”. The mean score of the attitude for preventing aspiration toward the dysphagia management of stroke patients’ caregivers was 24.1±6.8: in the order of caregivers (23.2±8.1), spouses (21.7±7.5), and children (18.8 ± 5.2).

Exploring Sociodemographic and Individual Factors Related to the Dysphagia Knowledge of Caregivers of Stroke Patients

The results of univariate regression analysis showed that the dysphagia knowledge of caregivers was associated with gender (Exp(B)=1.43), age (Exp(B)=5.10), education level (Exp(B)=9.51), the relationship with a patient (Exp(B)=6.38), total care period (Exp(B)=10.35), and care time per day (Exp(B)=2.30). The results of multivariate regression analysis indicated that the dysphagia knowledge of caregivers was associated with gender(Exp(B)=1.31), age(Exp(B)=4.35), education level (Exp(B)=8.62), and the relationship with a patient (Exp(B)=5.31) even after adjusting all confounding factors.

Table 1: The general characteristics of subjects (n = 83)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17 (20.2)</td>
</tr>
<tr>
<td>Female</td>
<td>66 (78.8)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>5 (5.7)</td>
</tr>
<tr>
<td>30-39</td>
<td>4 (4.3)</td>
</tr>
<tr>
<td>40-49</td>
<td>10 (12.9)</td>
</tr>
<tr>
<td>50+</td>
<td>64 (77.1)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>Elementary school graduates</td>
<td>8 (9.3)</td>
</tr>
<tr>
<td>Middle school graduates</td>
<td>19 (22.3)</td>
</tr>
<tr>
<td>High school graduates</td>
<td>41 (50.4)</td>
</tr>
<tr>
<td>College graduate and above</td>
<td>15 (18.0)</td>
</tr>
<tr>
<td>Illness</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>8 (10.0)</td>
</tr>
<tr>
<td>No</td>
<td>75 (90.0)</td>
</tr>
<tr>
<td>Subjective health condition</td>
<td></td>
</tr>
<tr>
<td>Very good</td>
<td>7 (8.6)</td>
</tr>
<tr>
<td>Good</td>
<td>50 (60.0)</td>
</tr>
<tr>
<td>Bed</td>
<td>21 (25.7)</td>
</tr>
<tr>
<td>Very bad</td>
<td>5 (5.7)</td>
</tr>
<tr>
<td>The relationship of the patient</td>
<td></td>
</tr>
</tbody>
</table>
Cont... Table 1: The general characteristics of subjects (n = 83)

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Status</td>
<td>4.12±1.03</td>
</tr>
<tr>
<td>Patient’s Dependency</td>
<td>3.88±1.05</td>
</tr>
<tr>
<td>Patient’s Future</td>
<td>3.83±0.98</td>
</tr>
<tr>
<td>Physical Health</td>
<td>3.58±0.93</td>
</tr>
<tr>
<td>Social Activity</td>
<td>3.50±1.08</td>
</tr>
<tr>
<td>Caregiver’s Future</td>
<td>3.17±0.95</td>
</tr>
<tr>
<td>Family Support System</td>
<td>2.40±1.11</td>
</tr>
<tr>
<td>Total</td>
<td>3.83±0.92</td>
</tr>
</tbody>
</table>

Table 2: The caregiver burden of stroke patients’ caregivers (n=83)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Item</th>
<th>Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Status</td>
<td>I am worried about the medical expense of the patient.</td>
<td>4.12±1.03</td>
</tr>
<tr>
<td>Patient’s Dependency</td>
<td>The patient always wants me to stay with him or her.</td>
<td>3.88±1.05</td>
</tr>
<tr>
<td>Patient’s Future</td>
<td>I am worried about the patient’s prognosis.</td>
<td>4.30±1.01</td>
</tr>
<tr>
<td></td>
<td>The patient can do almost nothing without my help.</td>
<td>3.78±1.25</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.83±0.98</td>
</tr>
<tr>
<td>Physical Health</td>
<td>I have to do all housework while I look after the patient.</td>
<td>3.30±1.18</td>
</tr>
</tbody>
</table>

Table 3: Caregiver burden by item (n=83)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Item</th>
<th>Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Activity</td>
<td>I cannot have enough personal time because I spend too much time to take care of the patient.</td>
<td>4.03±1.28</td>
</tr>
<tr>
<td></td>
<td>I am very tired of caring for the patient.</td>
<td>3.42±1.21</td>
</tr>
<tr>
<td></td>
<td>My health is worsened because I take care of the patient.</td>
<td>2.89±1.13</td>
</tr>
<tr>
<td></td>
<td>I feel under pressure due to the patient.</td>
<td>4.20±1.01</td>
</tr>
<tr>
<td></td>
<td>Even if I go out, I still pay attention to the patient.</td>
<td>4.26±0.95</td>
</tr>
<tr>
<td></td>
<td>I am getting emotionally drier.</td>
<td>2.81±1.20</td>
</tr>
<tr>
<td></td>
<td>I feel anxious even when I am with others.</td>
<td>3.41±1.01</td>
</tr>
<tr>
<td></td>
<td>I cannot sleep enough.</td>
<td>3.53±1.20</td>
</tr>
<tr>
<td></td>
<td>I am responsible for the patient more than I am able to.</td>
<td>3.38±1.23</td>
</tr>
<tr>
<td></td>
<td>I meet people less.</td>
<td>3.51±1.31</td>
</tr>
<tr>
<td></td>
<td>I do not enjoy my life.</td>
<td>2.87±1.16</td>
</tr>
<tr>
<td></td>
<td>Sub-total</td>
<td>3.50±1.08</td>
</tr>
<tr>
<td>Family Support System</td>
<td>My family does not appreciate my efforts.</td>
<td>2.44±1.11</td>
</tr>
<tr>
<td></td>
<td>I get angry easily and cannot bear emotions.</td>
<td>2.53±1.14</td>
</tr>
<tr>
<td></td>
<td>I feel like I am a victim of my family.</td>
<td>2.40±1.08</td>
</tr>
<tr>
<td></td>
<td>My relationship with other family members has been worsened due to the patient.</td>
<td>2.19±1.23</td>
</tr>
<tr>
<td></td>
<td>I feel resentful to other family members who do not take care of the patient.</td>
<td>2.46±1.21</td>
</tr>
<tr>
<td></td>
<td>Other family members are not interested in taking care of the patient.</td>
<td>2.29±1.05</td>
</tr>
<tr>
<td></td>
<td>Sub-total</td>
<td>2.40±1.11</td>
</tr>
</tbody>
</table>

Discussion

It is important to prevent and manage the dysphagia as soon as possible in order to maintain a healthy old age after the onset of stroke. The results of this study showed that ‘financial status’ was the most severe caregiver
burden among evaluated seven sub-domains. Our results agreed with previous studies\textsuperscript{22-24}, which reported that the financial burden was severe while caring for stroke patients. The results of this study indicated that the family caring a stroke patient suffered from lack of social activities due to the limitation of their personal life and the medical expense due to the extended illness period burdened individuals excessively.

In terms of the dysphagia knowledge of stroke patients’ caregivers, the results of this study revealed that children and spouses have significantly poorer knowledge for emergency responses as well as therapeutic management (e.g., sensory stimulation, oral exercise method, and how to use viscosity thickeners) than paid caregivers. Particularly, it was confirmed that, considering the highest incorrect answer rate of “keeping NG tube increases the possibility of aspiration pneumonia”, caregivers were only aware of the positive effects of NG tube insertion for preventing aspiration and they did not recognize the factor that long-term usage of NG tube could rather increase the occurrence of aspiration pneumonia. The NG tube can stimulate the nasopharynx continuously, resulting in excessive mucus secretion and, as a result, it can increase the risk of esophagitis due to gastric reflux or aspiration pneumonia.\textsuperscript{25,26} Therefore, it is necessary for the caregivers of stroke patients to reduce the NG tube insertion period and the incidence of aspiration pneumonia by applying appropriate nursing methods to restore the oral pharyngeal deglutition function. For this purpose, it is needed to provide correct information on the side effects of keeping the NG tube for the caregivers of stroke patients.

Conclusion

The results of this study showed that the main caregiver of a stroke patient suffered from the severe burden and did not have enough knowledge for the dysphagia management and aspiration pneumonia prevention. It is required to develop education materials for training dysphagia prevention caregivers based on the results of this study that can reduce the caregiver burden of the stroke patient’s family and reinforce the understanding and practice regarding the prevention and management of dysphagia.

Ethical clearance - The study protocol was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Source of Funding - This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2018S1A5A8028249).

Conflict of Interest - Nil

References


Nose Region Detection for Measurement of Non-Contact Respiration Rate Using Convolutional Neural Network

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Abstract

Background/Objectives: Vital signs are important clinical measurements that indicate the state of a person’s body. Although this technique has been used only in the medical field in the past, owing to the advances in technology, it is now being widely used for collecting information for various purposes by measuring the bio-signals of people.

Methods/Statistical Analysis: In this study, we propose a nose region detection method for measuring the respiration rate using thermal imaging. We use the characteristic that the temperature change in the nose region is visible in thermal imaging during breathing. Additionally, we confirmed the accuracy of nose region detection using CNN (Convolutional Neural Network) for continuous and automated respiration rate measurements. Faster-RCNN (Region with CNN features) was used as the CNN model.

Findings: In thermal images, we could find a clear temperature change between inspiration and expiration. However, we also found that the nose region in the thermal images did not show distinct features. This means that feature loss problems will occur in the training process. To solve this problem, we used ResNet to prevent feature loss problems in the training and prediction processes. Then, using the fact that the prediction result is output to a rectangular box, the mouth region is detected together with the nose region, and then the final nose region is determined after considering the geometric relationship between the two regions. We used three relationship; 1) distance between the nose and mouth, 2) horizontal length of the nose is shorter than the horizontal length of the mouth, and 3) the centers of the nose and mouth located on a vertical line.

Improvements/Applications: As a result, we confirmed the satisfactory performance of nose region detection in thermal imaging using CNN. In addition, detection accuracy is enhanced through additional verification of the prediction result.

Keywords: Vitalsign, Respiration rate, Convolutional neural network, Non-contact, Geometric relationship

Introduction

Recently, there has been increasing interest in non-contact bio-signal measurement systems. In the past, vital signs have been used for measuring changes in the body of an athlete or monitoring the health status of a patient. In recent years, as artificial intelligence (AI) technology has evolved, bio-signals are being used in many fields such as home systems, automobiles, entertainment, robotics, and human-computer interface. We are interested in the respiration rate, which can identify health status, emotional changes, among other bio-signals. The respiration rate can be measured using most vital signal measurement methods. However, as the contact-type method, which has been used in the past, is a method that takes direct measurements through a sensor attached to the body or through a device entering the body, the subject feels uncomfortable and limits his actions. For example, while measuring changes in the body during exercise, the subject may not be able...
to perform actions efficiently owing to the bio-signal measurement sensors attached to his/her body. Another example would be the negative impact caused by a sensor when it is attached to a baby having weak immunity. Therefore, a non-contact respiration rate measurement method is required, and studies for the same are being introduced.

We first introduce an existing contact measurement method. The characteristics used in the contact measurement method are divided into three major categories; 1) measuring with an ECG sensor, 2) measuring air flow, and 3) measuring the sound produced during breathing. Respiration is known to have an effect on ECG regulation. Therefore, by analyzing the pattern of change in the ECG, the respiration rate can be obtained. Studies using ECG are conducted as follows: 1) A method of identifying the respiratory cycle by applying the min-max detection method to the ECG-derived respiration (EDG) waveform extracted from the ECG signal, which is determined to be most effective using principal component analysis (PCA) [1]. 2) A method for detecting patients with apnea using ECG signals [2]. 3) A method for measuring the respiration rate from a single-channel ECG signal [3]. Generally, the respiratory cycle has the characteristic that the air around the nose is warmer when exhaled; this is owing to the influence of the body temperature. Studies based on this characteristic are conducted as follows: 1) A method of measuring the temperature change between inspiration and expiration using a nasal thermistor [4]. 2) A method of measuring respiration rate using a CO₂ sensor. Lastly, a microphone mounted on the neck for recording the sound generated during breathing and measuring the respiration rate [5]. The measurement methods presented so far demonstrate good results, but the disadvantage of the discomfort caused owing to their contact-type respiration measurement remains the same.

Non-contact measurement methods are also being actively studied. There exists a method for measuring the respiration rate by analyzing the movement of the subject’s chest or abdomen using Kinect equipment [6]. Additionally, there is a method for measuring the respiration rate using the change of light reflected on the bed while the subject is lying on the bed [7]. There are a number of methods in addition to the method mentioned above; however, we investigated the method of measurement using thermal imaging with in particular. There exists a study for measuring the respiration rate using the nose region as the region of interest (ROI) by tracking the face region in the thermal image in real time. A previous study exists that measures the respiration rate using the nose region as the ROI by tracking the face region in the thermal image in real time [8,9]. In these studies, the ROI (nose region) must be manually specified in the tracked face area and must be re-designated if the object leaves the screen. There exists a study of respiration monitoring method using nose region air change in a thermal image. However, it has a drawback of being affected by ambient temperature [10,11]. Additionally, there is a method for measuring the respiration rate by specifying the ROI of the carotid artery on the face and using the temperature change. However, the carotid artery is not a feature that is endorsed by all people, and even a person with a clear feature is greatly affected by the surrounding environment [12].

To solve the problems (e.g., unclear features and inaccurate ROI detection) observed in previous studies on non-contact measurement methods, we chose the nose region as the ROI with a clear temperature change and used the CNN model. The detection ability was confirmed after learning. The change in the temperature of the nose region in the thermal image can be seen in [Figure 1]

![Figure 1. Temperature change of the nose region in thermal imaging; (a) temperature at exhalation and (b) temperature at inhalation.](image-url)
The remainder of the paper is structured as follows: Section 2 provides detailed explanation from the data extraction environment to the nose region detection test in our proposed method. Section 3 lists the results of the test in the Results section. Section 4 provides conclusions and puts forth our future plan.

Materials and Method

This section presents an overview of the process from data acquisition to testing. First, the process of preparing a data set for learning is explained. Second, we introduce the network used as a CNN model and describe the design for solving the problems of thermal imaging. Third, we describe the geometric relationship used to increase the accuracy of nose region detection.

Preparing the datasets

Datasets (training set + test set) are required to learn the CNN model. First, we describe the video shooting environment for data acquisition. We placed the thermal imaging camera at a distance of 1m from the subject and installed it from the bottom to the top so that the nostrils could be clearly seen. The photography was carried out while the subject’s face did not leave the screen; the subject was free to carry out any facial movement. [Figure 2] illustrates the video capture environment. A total of eight people were photographed for 10 min at 30 frames per second. A total of 16,800 frames were used as a training set, and the remaining frames were used as a test set. Additionally, labeling for the nose and mouth regions (for verification of the predicted nose region) was conducted for learning purposes. The captured image and labeling are shown in [Figure 3].

![Figure 2. Video capture environment.](image)

![Figure 3. Photographed video. (a) original video. (b) labeling.](image)

Network & Training

Recently, as there is increasing interest in AI and its related technology, various models that can be applied to various fields have been developed. Most publicly known networks demonstrate good performance, although not in all areas. Therefore, it is important to select and use appropriate network for the task being performed. We decided that the object detection model is appropriate for finding the nose and mouth regions among several models. Additionally, there are many networks such as Faster-RCNN\textsuperscript{[13]}, YOLO\textsuperscript{[14]}, OverFeat\textsuperscript{[15]}, and SPPNet\textsuperscript{[16]} that are used for the task of object detection. Faster-RCNN is a model recognized for its performance in object detection. This is an acknowledged network for object detection in which speed and accuracy are improved through RCNN and Fast R-CNN. Faster-RCNN can be divided into three levels: 1) feature map extraction, 2) region proposal network (RPN), and 3) ROI pooling. First, in the feature map extraction step, a feature map is extracted from the input image through a convolution layer for collecting meaningful features to be used for learning. The extracted feature map is then input to the RPN. RPN is one of the important concepts in Faster R-CNN; it is a network that enables real-time nose region detection. RPN uses the sliding window technique to search the entire feature map and the extract ROI. Finally, we input the extracted ROI into the ROI pooling and use the classifier, and bounding box regressor to determine whether the candidate region is the desired object and the type of the class. Although all steps are important, the feature map extraction step is very important because it is a method of predicting the desired region through two or three steps, with the feature map extracted in the first step. However, as shown in [Figure 3], the feature loss problem may occur in the feature map extraction process because it does not show a clear feature of the nose region in the thermal image. We used ResNet\textsuperscript{[17]} as the network for extracting feature...
maps to solve this problem. When a general convolution layer is used, the characteristics of the nose region can be lost in the process of repeating the change of the input image size and applying the convolution filter. In fact, lowering the number of layers avoids the feature loss problem; however, the detection accuracy by the model can be expected. The concept conceived in these facts is ResNet. ResNet prevents the feature loss problem by sending the input feature to the next layer and combining them with the resulting features through the layer.

Geometric Relationship

We have used the geometric relationship between the nose and mouth regions from the learned model for determining the final nose region and verifying that it can increase confidence in the nose region. We used three geometric relationships: 1) distance between the nose and mouth, 2) horizontal length of the nose is shorter than the horizontal length of the mouth, and 3) the centers of the nose and mouth are located on a vertical line. These three relationships have been illustrated in Figure 4.

![Figure 4. Geometric relationships used; (a) using the distance between the nose and mouth, (b) using the fact that the horizontal length of the nose is shorter than the horizontal length of the mouth, (c) using the fact that the centers of the nose and mouth are located on a vertical line.](image)

Results and Discussion

To check the learning results, the learned model was applied to the video (the frame excluding the frame used for learning in the first captured image). Figure 6 shows the results of considering the model’s own predictions and geometric relationships before considering the geometric relations. As seen in Figure 5(a), almost regions were well detected but it was confirmed that a very small number of errors were observed in the entire image as Figure 5(b).

![Figure 5. Test results of the proposed model; (a) accurate detection results and (b) inaccurate detection results.](image)
In [Table 1], we applied the learned model to the video and visually confirmed the high performance. To confirm the quantitative performance, 1,000 frames were arbitrarily extracted from the images used in the test to confirm the mean average precision (mAP). The final region to be used was the nose region; therefore, we also checked the average precision (AP) of the nose and mouth. [Table 1] shows that the model itself does not exhibit bad performance. Additionally, the detection performance of the nose region can be improved through the verification process.

Table 1: AP for each region and the mAP

<table>
<thead>
<tr>
<th></th>
<th>Number of image</th>
<th>AP_nose(%)</th>
<th>AP_mouth(%)</th>
<th>mAP(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed model</td>
<td>1,000</td>
<td>94.7</td>
<td>97.0</td>
<td>95.9</td>
</tr>
<tr>
<td>Verified</td>
<td>1,000</td>
<td>96.0</td>
<td>97.0</td>
<td>96.5</td>
</tr>
</tbody>
</table>

Conclusion

In this study, we proposed a method for detecting the nose region in the thermal image for respiration rate measurement. The ROI used was as a nose region, with a clear temperature change between inspiration and expiration, and CNN was used for accurate ROI detection. Additionally, ResNet was applied for solving the problem that the nose region in the thermal image does not show distinct features. After learning the model, the accuracy of the detection of the nose region was improved through additional verification of the predicted region. Through this process, we can confirm the positive result of region detection in the thermal image using CNN. However, this study may have overfitting problems because it is conducted on a relatively small number, i.e., eight participants. We will increase the number of subjects in future studies, generalize them, and improve the performance of the model.

Ethical Clearance - Not required

Source of Funding - This research was funded by a 2019 research Grant from Sangmyung University.

Conflict of Interest - Nil

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An Adaptive Swarm Optimization Technique for Load Balancing and Task Scheduling in Cloud Computing

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Abstract

In recent era of growing technology, cloud computing has attracted various industries and researchers due to its significant nature in parallel and distributed computing systems. This technology has grown drastically in various real-time applications such as medical field, health organizations, multi-media applications etc. Cloud computing urges to provide better quality of service for clients or users. However, increasing demand of applications leads to the imbalance in cloud resources and causes huge power consumption in data centers. Due to multiple tasks imbalance occurs in cloud platforms which degrade the quality of service for clients. Task scheduling is considered as an important aspect which can be used for load balancing in cloud systems. This helps to allocate best available resources to complete the task by considering various other parameters such as computation time, scalability, makespan, throughput etc. However, various techniques have been proposed for task scheduling in cloud computing but these techniques still suffer from various issues such as makespan, execution time etc. To address this issue, an adaptive swarm optimization approach is presented for heterogeneous virtual machine systems. Proposed approach addresses the multi-objective problem by developing a probabilistic model resulting in optimization and convergence rate improvement. During task execution in cloud computing, if any VM is overloaded then the task is removed from that VM and proposed adaptive swarm optimization technique is used to find any other available optimal resource for task completion. An extensive simulation is performed along with comparative analysis. Experimental study shows that proposed approach outperforms when compared with state-of-art technique for load balancing in cloud computing systems.

Keywords—Cloud Computing, Load Balancing, Task Scheduling, Load-Balancing, Optimization

Introduction

Cloud computing is an emerging technology in today’s computer based application society where large scale distributed and parallel computing are adopted widely [1]. This technique of cloud computing is known as “on-demand” service and it offers various services (i.e. platform, information, software etc.) to the clients according to the client requirement for a given specific time. Generally, this technique is used over internet based application where entire internet can be considered as a cloud. By taking the advantage of cloud computing and internet, aforementioned resources can be accessed by the user from any place for a specific duration. However, the main aim of cloud service providers to offer various services to the customers with cost-effectiveness [2]. This includes large scale applications such as social-networking, storage, emails, online shopping etc. where cloud computing can be employed for cost minimization in various operations.

Cloud computing provides infrastructure, application platform and software which is available as subscription-based services known as pay-as-you-go model for clients. According to industrial application scenario, these services are termed as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) [3]. During last decade, two type of cloud platform have gained more attraction from researchers (i) Large-scale internet data centers like Amazon [4], Microsoft Azure [5] and (ii) co-location based data centers which are generally deployed in metropolitan area where smaller clouds are co-located physically for different geographical location users to
provide efficient services.

In cloud computing scenario, task scheduling plays an important role and considered as mind-boggling task for researchers. In cloud computing system, number of internet users could be in billions to access cloud based applications from all over the world where physical location of user is varied even for similar application usage. Therefore, large-scale task scheduling happens frequently among the cloud providers and the requesting users, which in turn becomes a significant problem to maintain efficiency. Performance of a cloud system is determined on various factors where efficient scheduling is one among them. Therefore, scheduling is one of the most important concerns while establishing cloud computing systems. Task scheduling techniques are utilized to find ways to assign certain number of tasks to the appropriate resource, and optimize the overall completion time to the least, which is an NP-complete problem \[6\]. In this paper, we consider the problem of scheduling a large amount of independent tasks in the heterogeneous collection of cloud resources, i.e., the virtual machines (VMs), so as to reduce the total completion time of the tasks.

According to the cloud computing systems, various parameters such as memory requirement, processor power, and bandwidth utilization also affect the performance of task scheduling. Moreover, heterogeneous nature of computing resources also causes complexity for efficient task scheduling. Furthermore, frequent data exchange occurs among multiple node, hosts and cluster takes place in data-intensive cloud application system which makes task-scheduling more complex. Recently, Zhao et. al. \[7\] developed a task-scheduling algorithm for cloud computing environment systems. Authors discussed about conventional approach for task-scheduling and developed Uniform Multi-Round () and (Master Service Uniform Multi-Round) Algorithm for task-scheduling. This approach helps to obtain better efficiency for working node for limited bandwidth scenario. Fang et. al. \[8\] presented a new approach to address the issue of resource utilization by developing an improved approach for task scheduling by considering new features of cloud computing such as flexibility and virtualization etc.

As discussed before in \[6\] that task scheduling and overall task completion minimization is a NP-complete problem, hence various technique which are based on the heuristic methods, have been proposed using evolutionary computation techniques. These techniques offer significant solution for NP-complete problem using various optimization schemes. In this field, genetic algorithm shows a significant impact on the performance of cloud computing based application system. Agarwal et al. \[7\] discussed about the challenges in cloud computing i.e. resource allocation and utilization and presented a new technique for resource management, bandwidth allocation using task scheduling technique. In order to carry out the research, Genetic Algorithm based task scheduling technique is discussed which helps to distribute tasks and loads effectively resulting in overall performance improvement of cloud computing system which shows improved performance when compared First - Come first - Serve (FCFS) techniques.

Aforementioned section discusses that VMs (Virtual Machine) concept can help to produce a better cloud computation system by creating, execution and managing of hosting environment for several applications and resources. In cloud based application, job arrival is complete random and unpredictable, moreover VMs capacities also varies which creates complexity. At this stage, load balancing becomes a tedious task resulting in performance degradation of cloud systems due to system instability. Hence, there is a need to develop an efficient approach for improving the system performance by balancing load among various virtual machines. There are various load balancing algorithms available, such as round robin, weighted round robin, dynamic load balancing, Equally Spread Current Execution (ESCE) Algorithm, Ant Colony algorithm, and Throttled algorithm. The most frequently used scheduling techniques for a no preemptive system are first in first out (FIFO) and weighted round robin (WRR) \[10\]. Existing approaches perform job scheduling and load-balancing but these techniques suffer from performance issue when heterogeneous cloud computing environment is considered. However, several techniques are presented for load balancing in heterogeneous networks. The overall performance further can be improvised by applying efficient task scheduling and load balancing scheme. Hence in this work, a new approach for task scheduling and load balancing is presented. Write Description about proposed approach (overview)

Recently, genetic algorithm, particle swarm optimization and various other optimization techniques have been introduced but overall performance of the
system is still a challenging task for researcher due to computational speed and efficient task scheduling. In order to address this issue, an adaptive optimization scheme is presented here resulting in performance improvement of cloud computing system. The main contribution of proposed approach are as follows:

An adaptive optimization approach is introduced which helps to obtain the optimal solution for any given problem.

In next stage, this approach is implemented for task scheduling and load balancing in cloud computing environment using probabilistic optimal solution computation.

In this work, multi-objective function is also presented which provides efficient task scheduling among multiple virtual machines. This reduces overall computation time, energy and implementation cost.

Finally, a comparative study is presented which shows that proposed approach obtains better performance in terms of task scheduling and load balancing when compared with state-of-art load balancing schemes.

Rest of the paper is organized as follows: section II briefs about recent studies about load balancing and task scheduling in cloud computing. Section III describes proposed solution, experimental study and performance is explained in section IV finally section V provides concluding remarks about proposed approach and its performance.

**Literature Survey**

In this section, a brief study is presented about recent techniques for task scheduling and load-balancing in cloud computing systems. Now-a-days, demand of cloud computing is increasing rapidly due to its significant nature for parallel and distributed computing. Clients demand for fast execution for any given specific task to reduce the overall computation time. This process is executed using various processing units which are known as virtual machines (VMs). However, limited resources are available for cloud computing hence it leads to task scheduling for efficient task completion for cloud users.

Optimization and evolutionary computation based schemes have played an important role for task scheduling in cloud systems. Recently, Xiong et al. [11] presented a task scheduling approach for cloud data-centers. This technique shows that operating systems, application program etc. can be operated from remote location and derived an approach for task scheduling. A combined approach for genetic algorithm and Johnson’s rule is presented which can offer task scheduling for multiprocessor architecture also. Furthermore, genetic algorithm is improved by deriving new function model for crossover and mutation whereas decoding process time is optimized by using Johnson’s rule.

Zuo et al. [12] proposed a task scheduling approach using optimization scheme and implemented for IaaS cloud systems. Generally, IaaS is offered to the users or clients who do not have sufficient resources for computation, therefore satisfying the Quality-of-Service demand becomes a challenging task. To address this issue of QoS in cloud, a new framework is presented for resource allocation where IaaS can outsource the task to external cloud according to the computational requirement. According to this approach, task scheduling problem is formulated in terms of integer linear programming computation model. This problem is solved and optimized using particle swarm optimization or self-adaptive particle swarm optimization based scheduling technique.

Domanal et al. [13] also used a bio-inspired technique for task scheduling and resource allocation for cloud computing systems. This study shows that conventional scheduling techniques such as First Come First Serve, Round Robin, Ant colony optimization etc. have been used widely and shown a significant impact of resource allocation and management in cloud computing. This performance is further improved by developing a hybrid model using modified particle swarm optimization algorithm and task scheduling is implemented using modified PSO and modified CSO. Along with load-balancing and task scheduling, energy awareness also a key factor which can degrade the performance of cloud system. Various techniques are presented where task scheduling and energy awareness issues are addressed.

Shi et al. [14] discussed about the advantages of VMs in cloud computing. VMs can help users to provide suitable job scheduling in a given infrastructure. This technique mainly aims of the job scheduling for parallel tasks set and measures energy consumption during compete task scheduling which can help to optimize the energy consumption. First of all, an analytical model is presented for resource allocation and task scheduling
problem is formulated in the form of Non-linear Mixed Integer Programming problem. To solve this, an equivalent linear programming solution is given for defined task scheduling problem.

Increasing demand of cloud computing leads to deployment of large data-centers which consumes huge amount of electrical energy. Along with this issue, cloud service providers must provide efficient delivery time to meet the client requirement. Less power consumption is helpful for recent green computing scenario. Horri et. al. [15] developed a novel approach for QoS aware virtual machine consolidation technique. This technique adopts resource allocation and utilization based on the cloud computing history. Similarly, Ding et al. [16] discussed about energy consumption issue in cloud data-centers. According to this article, conventional energy efficiency techniques are based on virtual machine concept and may not work if physical machines are hardware and DVFS (Dynamic Voltage and Frequency Scaling) also not utilized for energy saving. In order to address this issue, authors proposed EEVS approach for energy efficient technique for cloud computing by considering task deadline constraints. According to the working of this technique, physical machine contains a certain frequency parameter which can be used for processing VM. This assumption helps to obtain the optimal performance-power ratio resulting in weight of homogenous physical machine. In next stage, the PM which is having higher performance-power ratio will be assigned to VM resulting in energy saving.

Beloglazov et. al. [17] introduced a new architectural framework for energy efficient cloud model. This technique helps to improve the Quality of Service by providing a heuristic approach for data center resource allocation. Moreover, this work presents a brief study about energy-efficient management of cloud computing, energy-efficient resource allocation and scheduling for QoS improvement and open challenges in this field of cloud computing. A heuristic model is also developed for validating the results for proposed provisioning approach.

Power consumption issues are increasing in cloud data centers which causes environmental threats. During past decade, various techniques have been presented to obtain the optimal power consumption in cloud data-center. Ismail et. al. [18] proposed a new approach for cloud computing technique for optimization of power consumption by using task scheduling algorithms. Overloading and under-utilization of cloud computing resources leads to more power consumption hence power consumption controlling is required for cloud computing system resulting energy-efficient resource utilization. To overcome this issue, (Energy aware task scheduling) algorithm is presented which is used for dividing and scheduling the big data over cloud computing environment. This technique helps to reduce the energy consumption for varying load conditions.

Mansouri et. al. [19] discussed the issue of increasing cost for clients for utilizing cloud computing systems. This cost includes storage, data put and get cost, network cost etc. to address this issue of cost, an offline algorithm is presented where dynamic and linear programming techniques are considered which helps to determine the workload on a particular object. However, the dynamic load varies due to real-time load variation hence prior information of loads is required.

Various researches have been presented in this field of cloud computing which helps to provide task scheduling for faster completion load balancing, resource utilization, energy efficiency and (Quality of Service) etc. Due to increasing demand of cloud services and its significant nature for task completion, lots of users are utilizing this technique therefore workload and task varies according to the client requirement. Hence, task scheduling and load balancing is still a growing research and a challenging task for researchers.

**Proposed System**

Due to increasing demand of cloud computing system, number of task execution and workload balancing is becoming a growing research area in cloud computing field. In this work, we address this issue of task scheduling and load balancing and developed a new approach for efficient task scheduling and load balancing resulting in improved QoS.

First of all, VM modeling is presented in this section where various heterogeneous virtual machines are considered for analysis.

**Virtual Machine Modeling**

Generally, VMs (Virtual Machines) are obtained from the mapping of physical machines. In this section, a general model of VMs is presented as depicted in figure 1.
According to this, VMs and physical relationship can be obtained where set of physical machines is given as $Pm = \{Pm_1, Pm_2, ..., Pm_N\}$ where $N$ denotes the total number of physical machines present. Let us consider that VMs are the subset of physical machines and for physical machine $(Pm_i)$, it can be named as $VM_{i1}, VM_{i2}, ..., VM_{im_i}$ where $m_i$ denotes the number of VMs present on the physical machine. Let us consider that $V$ number of virtual machine deployment is needed whose mapping solution set can be represented as $S = \{S_1, S_2, ..., S_N\}$ to each physical machine present. Here $S_i$ denotes the solution for $V$ virtual machine which is placed in physical machine $P_i$.

**A. Load Expression in Cloud Computing**

This subsection presents the computational expression of load in VM based cloud computing systems. In order to obtain the overall load on physical machine, load of each virtual machine can be added resulting in complete load information about specific physical machine. For load analysis, time span also plays an important role, let $T$ be a time span where load monitoring is carried out precisely. However, computational loads have varying nature based on the time duration. Hence, total computational time can be portioned in multiple time periods such as $T = \{(t_1 - t_0), (t_2 - t_1), ..., (t_n - t_{n-1})\}$ where current time and previous monitored time spans are considered for expression. In other words, it can be denoted as $(t_k - t_{k-1})$ by considering $k$ as time period for load analysis. In case, if load is moderately stable in each time period then load for VMs in time period $k$ can also be defined. With the help of this, average load on each VM can be given as presented in Eq(1):

$$\overline{V_i}(i,T) = \frac{1}{T} \sum_{k=1}^{n} V(i,k) \times (t_k - t_{k-1})$$

(1)

In general, overall load parameters or values can be obtained by adding loads of all running virtual machines. Overall load of any physical machine can be expressed as Eq(2):

$$Pm(i, T) = \sum_{j=1}^{m_i} V_i(j,T)$$

(2)

Prior to deployment, entire information required for VM deployment is pre-defined which can be used for load estimation and information extraction from virtual machines. Hence, during deployment of virtual machine $V$ in physical machine, the load of each physical machine can be defined using Eq (3).

$$Pm(i, T) = \{Pm(i, T) + V \text{ after deployment of virtual machine } \} \text{ others}$$

(3)

Virtual machine placement in physical machine causes certain changes in system load which motivates to perform load adjustments for achieving load balancing. These changes affect the load mapping solution $S_i$ in given time span $T$, this load variation for each physical machine can be given as Eq. (4):

$$\sigma_i(T) = \sqrt{\frac{1}{N} \sum_{l=1}^{N} \left( Pm(T) - Pm(i, T) \right)^2}$$

(4)

Where $\overline{Pm(T)} = \frac{1}{N} \sum_{i=1}^{N} Pm(i, T)$

Above mentioned virtual machine modeling and load computation sections presents a general model used for cloud load balancing. These models are utilized for obtaining the best solution for cloud computing systems. In order to perform the load-balancing, an adaptive approach is presented which shows working similarity with particle swarm optimization but it is capable to provide better optimal performance for cloud computing environment.
Algorithm 1: Basic procedure of conventional particle swarm optimization based scheme

<table>
<thead>
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<th>Step</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Initialize computation</td>
</tr>
<tr>
<td>2</td>
<td>For (All food in various location)</td>
</tr>
<tr>
<td>3</td>
<td>Initialization</td>
</tr>
<tr>
<td>4</td>
<td>Allocate distance and direction parameters for movement</td>
</tr>
<tr>
<td>5</td>
<td>Compute initial fitness value</td>
</tr>
<tr>
<td>6</td>
<td>Substitute all fitness values into the fitness function</td>
</tr>
<tr>
<td>7</td>
<td>Find best fitness value based on the fitness function</td>
</tr>
<tr>
<td>8</td>
<td>Obtain the location of best fitness value</td>
</tr>
<tr>
<td>9</td>
<td>End for</td>
</tr>
<tr>
<td>10</td>
<td>While stopping condition is not exceeded</td>
</tr>
</tbody>
</table>

The above mentioned technique is well-known for obtaining the optimal solution by communicating with neighboring candidates and finds the best location based on the fitness value computation. Generally, this stage consists of six stages as: initialization stage, parameter assignment stage, evaluation phase, fitness values substitution stage, identification stage and optimal solution selection stage.

In the first stage, all required parameters are initialized which are required for finding the optimal solution such as initial population size, initial random locations and maximum number of iterations. As discussed in algorithm 1, moving direction and distance are also assigned which comes under parameter assignment phase. This can be represented using Eq. (5).

\[
X_k = X + \text{Random}(D) \\
Y_k = Y + \text{Random}(D)
\]

Where \(D\) denotes assigned distance parameter. In next phase, evolution process is applied where particle location for each swarm and distance of particle source is estimated to compute the desired optimal solution. Evaluation can be represented as Eq.(6):

\[
\text{Dis}_k = \sqrt{(X_k - X_s)^2 + (Y_k - Y_s)^2}
\]

Next step is to compute fitness function and substituting the obtained value. Fitness function gives the best fit value during each iterative computation. This fitness function is used for identifying the maximal fit value for finding the best solution. This selection helps to obtain the optimal solution which has the maximum fitness value.

In this work, our main aim is to develop a new approach for load-balancing in cloud computing for improving the overall performance of cloud computing system environment. In order to carry out this work, first of all, load-balancing problem is formulated for cloud environment by considering various heterogeneous virtual machines.

### A. Problem Formulation and Optimal Solution

This section provides problem formulation for load-balancing in cloud. Let us consider that total \(m\) number of physical machines are present in the cloud data center which can be represented in the set such as \(P = \{p_1, p_2, p_3, \ldots, p_m\}\) and \(q\) number of virtual machines are present denoted as \(V = \{v_1, v_2, v_3, \ldots, v_q\}\) and total \(k\) number of tasks are also considered as \(T_k = \{t_1, t_2, t_3, \ldots, t_k\}\). During computation phase, cloud user provides the task to cloud broker to obtain the desired output from the given task. This task is formulated in the form of group and passed to cloud broker. This group contains various parameters such as task arrival time \(T_{arr}\), task size \(T_{size}\), task deadline \(T_{deadline}\) and task finishing time \(T_{finish}\). It can be represented in the group form as \(T_k = \{T_{arr}, T_{size}, T_{deadline}, T_{finish}\}\). This task is processed by cloud broker and mapped to the virtual machine \(VM_j\).

Here our main aim is to focus on load-balancing and task-scheduling in cloud computing systems.

Let us consider that processing time for all tasks is denoted by \(P_i\) which can be expressed as Eq. (7):

\[
P_i = \sum_{j=1}^{m} P_{ij} j = 1, \ldots, m
\]

For load balancing in cloud computing environments, virtual machine capacity also a significant parameter which can affect the performance of cloud computing systems. Generally, virtual machine capacity depends on the processing elements, processor counts and the bandwidth of current resource. This relationship can be computed as given in Eq. (8).

\[
cap_j = p_{e\text{num},p_j} \times p_{\text{mips},p_j} \times v_{\text{bw},v_j}
\]

Where \(p\) is the processing elements, \(p_{e\text{num},p_j}\) denotes total number of processor count, \(p_{\text{mips},p_j}\) denotes MIPS of all processors and \(v_{\text{bw},v_j}\) is bandwidth parameter of virtual machine \(VM_j\). Load of any particular virtual machine can be given by taking the ratio of total number of tasks to be executed and available service rate of virtual machine. This can be computed as Eq. (9).

\[
L_{VM(i)} = \frac{\text{Num}(T_k,t)}{SR(V_p,t)}
\]

Here load of virtual machine is denoted by \(L_{VM}\) at any specific time \(t\), total number of task at the same point are denoted by \(\text{Num}(T_k,t)\) and \(SR\) denotes the service rate of virtual machine \(VM_j\) at time \(t\). As discussed before that combination of load of each virtual machine load is the overall load of the cloud system i.e., \(Load_{VM} = \sum_{i=1}^{m} L_{VM(i)}\). With the help of these assumptions, processing time of virtual machine and task execution time can be estimated. Processing time for each virtual machine is given as Eq. (10).

\[
PT_{VM} = \frac{L_{VM(i)}}{\text{cap}_j}
\]

Whereas overall processing time can be given as (6)

\[
PT_{VM} = \frac{\text{Load of all virtual machines}}{\text{capacity of all virtual machines}}
\]

Similarly, task execution time \(T_e\) can be computed by using Eq. (11) as expressed

\[
T_{Execution} = \frac{T_{size}}{c(VM_j)}
\]

Let us consider that \(ST_{ij}\) is the start time of task on virtual machine \(VM_j\) and finishing time is \(T_{finish_j}\) of task.
\( t_i \) hence overall task finish time can be computed using Eq. (12):

\[
T_{\text{finish},i} = T_{\text{start},ij} + T_{\text{execution}} \quad (8)
\]

Further, we use a decision variable here denoted as \( x_{ij} \) which is used to determine that each task should be allocated to one virtual machine where processing time of task and virtual machines are denoted as \( P_{ij} \) and \( V_i \) respectively. This relationship can be expressed as given in eq. (13).

\[
x_{ij} = \begin{cases} 1 & \text{if task is assigned to the virtual machine and } T_{\text{finish},ij} < T_{\text{arr},i} \\ 0 & \text{otherwise} \end{cases} \quad (9)
\]

With the help of this function, we formulate an objective function for load-balancing in cloud computing systems. This objective function can be defined as Eq. (14):

\[
F_i(Y) = \min \left\{ \max_{t_i \in T_k, v_i \in VM} T_{\text{finish},ij} \right\} \quad (10)
\]

In this process of load balancing, response time also a crucial parameter which can be computed as Eq. (15):

\[
R_{\text{time}} = T_{\text{finish},i} - T_{\text{arr},i} \quad (11)
\]

In this article, an adaptive swarm optimization technique is presented resulting in load-balancing in cloud datacenters. Conventional swarm optimization techniques fail to obtain significant performance in terms of optimization accuracy. Proposed approach is two techniques where in first stage, swarm is initialized and moves in different random directions by following a uniform data distribution. In second stage, a probabilistic model is applied which helps to obtain the updated location of current swarm and achieves better performance for premature convergence also. Hence the proposed approach is capable to improve both convergence and optimization performance which can improve the overall performance of optimization system. In order to perform this operation, proposed adaptive swarm optimization approach formulates an initial problem where multiple VMs are considered where various tasks are also allocated to each virtual machine. According to this approach, initially loads are identified whether balanced or not by considering VM load threshold values. In this process, if any virtual machine is found to be overloaded then the on-going task is removed from virtual machine. This task is termed as adaptive

swarm optimization, as discussed before that swarm optimization approach performs the searching operation for optimal solution. Here, optimal location is identified as virtual machine where removed task can be assigned to the best optimal location i.e. best optimal VM. Usually, location of available virtual machine is obtained and removed task is assigned to the virtual machine. This process is repeated until all virtual machines have balanced loads in any considered datacenters. Furthermore, for location updation and optimal solution computation is performed using probabilistic approach where multi-objective function helps to determine the fitness value for particular virtual machine.

B. Load Balancing using Adaptive Swarm Optimization

Proposed adaptive swarm optimization performs search operation to find the food (Virtual machine) and its location by communicating with neighboring swarms. According to proposed approach, removed task is considered as swarm which uses multi-objective function for optimal virtual machine selection for task completion in desired time and task deadline constraints. In this process, various basic constraints are also considered such as initial load of any virtual machine should not be greater than the threshold, deadline constrains are considered for multiple virtual machine scenario where task can be migrated from heavy loaded VM to low loaded VMs. Here, removed task deadline \( T_{\text{deadline}} \) provides the information about assigned tasks to the virtual machine such that if \( T_{\text{deadline}} \) is higher for removed task then minimum deadline tasks are present whereas if medium task deadline task is removed then less number of high deadline are present. Moreover, we apply virtual machine grouping where under-loaded \( (VM_{\text{Group}}) \) and overloaded \( (VM_{\text{Group}}) \) machines are grouped. Task is removed from overloaded VM \( (VM_{\text{Group}}) \) and assigned to \( (VM_{\text{Group}}) \) with the help of objective function computation. This complete process of task removal is performed until \( (VM_{\text{Group}}) = NULL \). This process can improve the performance in terms of energy also resulting in implementation cost reduction. This process of load-balancing is depicted in given in algorithm 2.
Algorithm 2: Load-balancing using proposed adaptive swarm optimization technique

Step 1: initialize simulation with complete desired parameters.
Step 2: is the swarm during simulation
Step 3: Set and
Step 4: For each datacenter do
Step 5: for each virtual machine in the datacenter
Step 6: Apply virtual machine capacity and load computation using equation (8) and (9) respectively.
Step 7: evaluate capacity and load for load balancing
Step 8: if then
Step 9: load balancing cannot happen
Step 10: else if then
Step 11: balanced load for each virtual machine. Load balancing is not required
Step 12: Exit
Step 13: End if
Step 14: For each in number of available swarms
Step 15: generate number of total swarms
Step 16: for each in VM do
Step 17: if then else
Step 18:
Step 19: end if
Step 20: end for
Step 21: end for
Step 22: for each swarm, generate neighbouring swarms
Step 23: if
Step 24: apply sorting in ascending order
Step 25: task sorting based on the deadline constraints
Step 26: for each assigned task in do
Step 27: Find best VM from under loaded virtual machines.
Step 28: end for
Step 29: apply task migration or reallocation to the best suitable under-loaded VM
Step 30: Else move virtual machine to sleep mode // energy constraints
Step 31: update parameters such as task list, load on virtual machine s and available virtual machines.
Step 32: End

Using this technique of load-balancing, we improve the cloud computing performance. Next section deals with complete simulation study, experiments and comparative analysis.

Experimental Study

In this section, an extensive simulation study is presented for load balancing in cloud computing systems. This study is carried out using MATLAB simulation tool on windows operating systems with 8 GB RAM Intel i5 processor. However, MATLAB is considered here for simulation study and comparison due to its nature of data analytics for large scale simulations. For this simulation study, total 6 number of data centers are considered where 50 virtual machines are present and total 1000 number of tasks are given for performance analysis. Complete simulation parameters are presented in table 2.

<table>
<thead>
<tr>
<th>Simulation Parameter</th>
<th>Parameter value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of task</td>
<td>1000-20000 MI</td>
</tr>
<tr>
<td>Total number of task</td>
<td>100,200,300,400,500</td>
</tr>
<tr>
<td>Number of VMs</td>
<td>50</td>
</tr>
<tr>
<td>MIPS</td>
<td>500-2000</td>
</tr>
<tr>
<td>VM memory (RAM)</td>
<td>256-2048</td>
</tr>
<tr>
<td>Datacenters</td>
<td>6</td>
</tr>
<tr>
<td>Total number of hosts</td>
<td>3-6</td>
</tr>
</tbody>
</table>
We conducted various experiments by varying number of tasks and number of VMs based on these variations, performance of proposed approach is carried out in terms of makespan, task completion time, number of task migrations and number of delayed tasks. Performance of proposed approach is compared with conventional, round robin, weighted round robin and improved round weighted round robin with job length [20].

Figure 2. Execution completion performance

Figure 2 shows a comparative analysis in terms of task completion or execution completion time. To obtain this performance analysis, number of virtual machines are varied from 10 to 100 and task competition time is evaluated. Here, static round robin, weight round robin, improved round robin and proposed approaches are compared. Simulation study shows that proposed approach outperforms when compared with existing techniques. During this process, load balancer is executed at the end of each task. At this phase, it computes the expected time to complete the task. If the virtual machine is already overloaded, then task is assigned to other optimal virtual machine which helps to improve the overall performance of proposed approach. Similarly, average task completion time performance is also evaluated and compared with other techniques. This analysis is depicted in figure 3.

Figure 3. Average task completion time

Another performance parameter is considered as total number of task-migration during computation phase. In this case also, number of virtual machines are varied from 10 to 100 and performance is evaluated in terms of total number of task migration. As given in table 2, we have varied number of task set hence performance is compared by varying the number of tasks and virtual machines. First of all, total 100 number of tasks are given for 100 virtual machines. Performance comparison is presented in figure 4.

Figure 4. Number of task migration performance

For overall performance evaluation, we have considered 100 virtual machines and number of tasks are varied from 100 to 500. Based on this simulation comparative performance analysis is presented in figure 5. This analysis shows that proposed approach gives a significant performance for large number of task sets when compared with state-of-art techniques.

Figure 5. Number of task migration performance

Another analysis is carried out where makespan is evaluated for varied virtual machines. This also can be carried out for varied number of tasks. In order to show the robustness of proposed approach, virtual machines are varied and performance is evaluated as depicted in figure 6.

Figure 6. Makespan performance comparison analysis
This complete study shows that proposed approach gives better performance in terms of makespan, task completion time and task migration etc. according to the analysis, execution time performance of proposed approach is improved by 26.62%, 23.13% and 17.89% for static round robin, weighted round robin and improved round robin respectively. Similarly, task migration is also reduced by 51.93%, 48.52% and 44.58% for static round robin, weighted round robin and improved round robin respectively. Similarly, makespan is also improved using proposed approach which can provide better stability and on-time task completion.

**Conclusion**

This manuscript studies about cloud computing and deals with load balancing in cloud computing. Increasing demand of cloud computing leads to execute huge amount of tasks on cloud environments which causes imbalance. Hence the performance of cloud computing degrades due to load imbalance. This issue can be addressed by using load-balancing approach. In this work, we have developed an adaptive swarm optimization technique with the combination of probabilistic model for optimizing and scheduling various task during run time. Proposed approach carries a dynamic threshold value for load data on each virtual machine in the considered data center. This threshold value helps to reduce the energy consumption, implementation cost and task execution time. Load balancing problem is considered as NP-complete problem hence a general optimization problem is formulated and solved using an adaptive swarm optimization approach. Experimental study shows that proposed approach outperforms when compared with round robin and improved weighted round robin algorithms for load balancing in clouds. In future, we aim on further optimization of cloud computing systems for energy awareness along with job scheduling technique.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** - Nil

**References**


An Adaptive Bayesian Computation Model for CDMA Multiuser Detection using Evolutionary Computation Scheme

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Abstract

Demand of wireless communication is increasing drastically where CDMA (Code Division Multiple Access) is considered as most promising technique for real-time communication. However, due to extreme utilization of these technologies several challenges occur such as interference and packet drop resulting in poor communication. To address these issues, multi-user detection schemes have been adopted widely which are based on the filtering techniques and MMSE (Minimum Mean Square Error) based multiuser detection schemes. In this work we address these issues and proposed a novel approach of multi-user detection for asynchronous CDMA using combined optimization and evolutionary computation. Bayesian computation model is applied which helps to compute the Log Likelihood Ratio (LLR) using Monte Carlo simulation. Later genetic algorithm is incorporated to obtain the optimal solution for LLR probability resulting in reliable communication. An extensive simulation study is presented which shows significant improvement in the performance when compared with state-of-art multiuser detection schemes.

Keywords—CDMA, Multiple access interference (MAI), Multi user detection, Bayesian Model, evolutionary computation, Log-Likelihood ratio.

Introduction

Recently, wireless communication has put forward due to its importance in various applications such as research application, industrial application, medical etc. The performance of wireless communication depends on various parameters which are rate of data transmission, power density, communication interference and multi-path resolution. Various techniques have been introduced for fruition of this type of demand to real-world communication scenario. In this field of wireless communication, CDMA (Code-Division Multiple Access) is considered as most popular technique for communication. These type of wireless communication systems are used for cellular radio communication where multiple access scheme can provide minimum cost for implementation and performance maximization which helps to improve the overall performance of communication system and delivers a better QoS (Quality of Service) for end-user experience. For further improvement in communication system, various multiple access based schemes has been developed. Recently, MC-CDMA (Multi-Carrier Code Division Multiple Access) (Wang et al., 2015) scheme is developed for CDMA systems. Similarly, another significant approach is known as DS-CDMA (Direct-Sequence Code-Division Multiple Access) (Shi et al., 2017). Communication through these systems depend on the orthogonal frequency and distinct codes. According to CDMA process, distinct codes and user are multiplexed whereas in FDMA (Frequency-Division Multiple Access) (Ding et. al., 2017) orthogonal frequency and users are multiplexed, similarly in TDMA (Shafie et. Al., 2017) (Time-Division Multiple Access) time-slots are users are multiplexed.

In this work we focus on generalized CDMA system for cellular communication network. During communication, multiple users participate to complete their desired communication process which motivates CDMA systems to ensure higher capacity which can be induced by using CDMA spreading signature and multiuser detection schemes at the receiver end. As discussed before that multiple user perform
communication using CDMA system where user-interference degrades the communication quality. Another issue is caused due to inter-block interference and multiple-access interference for uplink and downlink communication scenario. Interference can be mitigated using blind channel estimation based schemes (Miyajima et al., 2015) CDMA based communication receivers suffers from various issues such as near-far effect. In order to mitigate this effect and improve the communication quality, power control policies are considered as most promising technique (Sim et al., 2003). (Townsend et al., 2011) discussed about near-far effect in ultra-wideband (UWB) techniques. (Townsend et al., 2011) discussed symbol-level synchronization scheme is presented for near-far effect reduction without using power control technique. This model supports communicating waveforms without requiring the knowledge of spreading codes. Mainly this technique uses two main techniques which are known as: suppression technique and dimension detection technique. For large communication system, CDMA suffers due to performance limitation. For this performance degradation, multiple-access interference is the crucial component which is responsible for degraded performance in CDMA systems. Similarly, (Shen et al., 2017) discussed about the issue of multiple-access interference and developed a new technique for mitigation. This process considers information recovery and signal acquisition while mitigating the interference. This work is carried out using an open-loop adaptive filter which is based on the iterative minimum mean-square error filtering model. Along with power control strategies, multiple access interference can be reduced by using multi-user detection model. Zhang et al. (2015) presented an enhanced technique for multiuser detection along with interference cancellation for (orthogonal frequency division multiple access) using IEEE 802.16m standards. In this process, initial ranging is applied to detect the valid path, path selection is performed based on the signal-to-interference–pulse–noise ratio and path parameters are computed using least-square method. Zhou et al. (2014) discussed about ultra-wideband where Gaussian approximation is used for MAI (multiple access interference). In UWB scenario, small number of active users cause strong interference resulting in performance degradation for UWB receivers. To address this issue, Generalized Gaussian distribution technique is employed for improved performance.

Recently, various techniques have been introduced to minimize the (Multiple-access interference) effect and improving the communication based on the multiuser detection schemes. Steiner et al presented a new approach for multiuser detection using linear modeling of for based application where flat fading channels are considered for communication. It is assumed that multiple users are communicating on a system where system load is kept fixed over a large spreading sequence. In this work, linear detectors also used such as matched-filter and decorrelator which helps to reduce the interference during communication (Steiner et al., 2012). Another models such as decision feedback detector, MMSE also helps to cancel the interference. However, multiuser detection schemes are most significant techniques which can improve the performance of the system. Liu et al. (2017) presented a new approach for MIMO (Multiple-Input-Multiple-Output) systems and presented a study about channel estimation error using log-likelihood ratio (LLR). In this process, data is transmitted from source to destination where quadrature amplitude and Rayleigh fading is used for communication purpose. This work presents a combination of MMSE, LLR and channel estimation error for CDMA systems. Furthermore, a power-allocation scheme is also presented in this work.

A significant amount of work has been done in this field of CDMA based communication system but the demand of wireless communication is increasing drastically which motivates us to deploy a huge CDMA based communication network to satisfy the user request of communication. Increasing demand of communication causes interference as discussed before. In this work our main aim is to develop an efficient technique for multiuser detection by reducing the interference during communication. To carry out this work, a general CDMA system is employed for communication aiming on the implementation of a receiver to meet the objective of multiuser detection resulting in interference cancellation and performance improvement. Conventional techniques of CDMA receivers are complex to implement, hence here we develop a low-complexity scheme which is capable to cop-up the near-far issue for multiuser detection.

Main contribution of this work are as follows:

Developing a system mode for CDMA system

Designing an optimal technique for multiuser detection
Introducing a combination of optimization approach for multiuser detection system.

Presenting a comparative study to point out the advantage of proposed approach.

In this work, our main aim is to develop an efficient technique for multi-user detection in CDMA systems. However, conventional techniques are present which fail to achieve the desired performance. Hence in this work we present a novel approach where first of all a CDMA model is developed using mathematical computation. In the next phase, we introduce Bayesian algorithm is implemented for LLR computation and finally, genetic algorithm is incorporated to improve the reliability of LLR probability values. Recently, Kumar et al (2017) developed Bayesian coalition based scheme for secure energy management scheme which uses game theory approach. This study shows that Bayesian Coalition approach can provide better ways to improve the communication performance. Prior to this work, Kumar et al (2014) developed a data forwarding scheme using Bayesian Coalition Game.

The paper is organized as follows. Section 2 deals with recent studies in this field of CDMA based communication system. First of all, a brief description about communication model and channel is presented in section. Section 3 presents proposed optimal model for multiuser detection. Section 4 presents experimental study for various test cases and finally a comparative study is presented at the end of experimental analysis. Section 5 deals with concluding remarks of proposed approach of multiuser detection for CDMA based communication systems.

Related Work

This section presents a brief study about recently developed CDMA techniques. This study about CDMA includes various aspects where power allocation, interference reduction, performance improvement etc. are discussed. in previous section, we have discussed about various types of multiple access systems such as CDMA, DS-CDMA, MC-CDMA etc. For each type of CDMA system, multiuser detection improves the overall performance of network. Based on this assumption, Sigdel et al. (2003), presented a study for MC-CDMA systems for uplink application scenario. This work also considers multiuser detection scheme to mitigate the interference effect during communication. This work presents study about both synchronous and asynchronous CDMA systems in a slow fading channel environment. For complexity reduction, array-processing method is used along with Eigen modeling. During simulation, effect of correlated channels is also studied for asynchronous uplink CDMA communication system. Multi-carrier based CDMA based systems also widely used for various real-time applications. Wang et al. (2012) proposed a new approach for CDMA communication systems. This scheme depends also aims on the resource allocation for multi-carrier DS-CDMA systems. This model follows power control policies for obtaining the improved performance by developing a non-cooperative. The performance is measured in terms of packet throughput. Proposed scheme uses adaptive power allocation scheme with Gaussian Approximation model where channel estimation error is also discussed. For multiuser detection process, filtering technique is also developed where multiplicative noise is considered for communicating channels. In each communicating symbol, channel response receives a random distribution for multiuser detection which can be utilized for CDMA systems in fast fading environment. Using this technique of multiuser detection, performance of CDMA systems can be improved (Zhang et.al. 2007).

For multiuser detection over fast fading channels is a crucial step for researchers. Due to the nature of fast fading of channels, significant performance of the system cannot be obtained precisely. To mitigate this issue of MUD for fast fading channels, Bao et. al. (2017), developed a new approach known as joint multiuser detection. This model analyses the error performance in both multiple access and broadcast channels. This work helps to obtain the pairwise error probability computation by introducing closed-form expression in joint maximum likelihood detection for AWGN and Rayleigh fading scenarios. For this study, random users are considered and pairwise error probability function is applied for multidimensional constellation. To minimize the error, upper-bound conditions are computed resulting in reduction of average error of the system.

(Aktas et.al., 2012), authors have presented a new approach for CDMA systems where belief propagation algorithm is developed for CDMA systems which are based on the pilot-assisted reception. Inputs to these datasets are provided in terms of symbols which are obtained by applying BPSK (Binary Phase Shift Keying). This model uses a Bayesian network graph
for representing the channel parameters where random variables are used to denote the communicating node. For channel consideration, frequency and time domain parameters are considered during graph construction. For symbol consideration, constructed graphs are used whereas channel parameters are formulated using Gaussian distribution parameters. This system shows significant outcome but implementation complexity still remains a challenging issue. Tyagi et al. (2015) discussed about Bayesian Coalition Game for wireless sensor networking systems.

In literature review various detection schemes have been discussed which are based on the matrix based computation process. These schemes are known as zero-forcing detection, minimum mean square error method (MMSE) and decision feedback detector which are implemented for CDMA systems. To improve the performance of these detectors, De et al. (2012) developed a new approach where Cholesky decomposition is used for data decomposition in CDMA based systems. The main issue with Cholesky decomposition is experience due to its time-varying nature and computation operations. Moreover, computation of filtering weights is the main issue which increases computational complexity. Authors presented a novel approach to address these issue by computing Cholesky decomposition with the help of autocorrelation matrix for multiple access systems. This work uses a weight computation and weight update approach where weight of each segment is updated resulting in complexity reduction of the system. The obtained matrix is not diagonal constant which uses developed shift structure for computation in long-code CDMA system. Lu et al. (2011) discussed about multiuser detection schemes aiming on the complexity reduction of the CDMA systems. In this work, authors discussed three approach of multiuser detection which provide low-complex and cost effective solution for the uplink communication in spatial frequency time domain and multicarrier DS-CDMA. According to this process, after receiving the signal, MUD converts the signal according to the required format. In the next stage, 1D-MMSE and 2D-MMSE detectors are applied to detect the transmitted symbols in iterative manner. During each iteration, weight of 1D detector and 2D detectors are computed and updated by minimizing the mean-square error. For 2D MMSE detectors, previously computed weights are used to update the weight in next iteration.

Almeida et. al. (2013) studied about DS-CDMA based communication system. In this study, authors found that conventional CDMA systems still suffer from the performance degradation issues such as packet drop, BER and SNR etc. To improve the performance of conventional DS-CDMA, authors developed a cooperative scheme for DS-CDMA. According to this strategy, communication between users and base station is established directly where direct link and communication relays are used for communication. These systems also suffer from the issue of multiuser detection hence this work address this issue by proposing a new approach by considering joint estimation of spatial parameters, channel gain and all transmitted symbol. This technique is developed using trilinear modelling where source, relay and destination links are combined together for establishing the communication. This work improves the performance of conventional DS-CDMA systems which are based on trilinear system. Performance issue of DS-CDMA is addressed by developing cooperative communication scheme. Seo et al. (2012) presented an improved approach for Multi-carrier CDMA system using multiuser detection scheme. This work is based on the offset frequency estimation and compensation. In order to normalize the offset frequency subcarrier spacing is applied which is also known as normalized residual frequency offset (NRFO). This work also computes the lower bound of the signal to interference plus noise ratio. Furthermore, the detection filter designing uses maximization of SINR lower bound. Recently, optimization techniques are also incorporated for multiuser detection in CDMA system for performance maximization. These optimization techniques are known as ACO (Ant Colony Optimization), PSO (Particle Swarm Optimization), Genetic Algorithm etc. These techniques result in notable performance of the system which motivates to utilize these approaches for CDMA communication. By taking this into account, Marinello et. al. (2014) developed an improved technique of multiuser detection for DS-CDMA based systems. This technique is a combination of Ant Colony Optimization and multiuser detection by optimizing the input parameters. This study shows that multiuser detection techniques are NP complex in nature which can be solved by using optimization problem. Main aim of this technique is to solve the optimization problem in a given computation time and obtaining an efficient performance for data detection. Moreover, Monte-Carlo simulation technique is also used here for analyzing the
performance of Ant Colony multiuser detection system. Liu et. al. (2011) presented a new approach for multiple access system performance improvement. This technique is also based on the offset frequency modelling unlike previously discussed frequency offset normalization technique. This technique is developed for single-carrier code division multiple access systems using frequency domain equalization. Furthermore, it has a significant impact on the reduction of PAPR (Peak-to-average power ratio) and provides higher diversity in the frequency distribution when compared with OFDMA system. This model gives a significant performance improvement for asynchronous multipath CDMA systems by reducing interference when compared with RAKE-based CDMA communication systems. All existing techniques for SC-FDMA uses carrier-frequency offset (CFO).

Chen et. al. (2015) presented an improved approach for decoding and multiuser detection for spectral-amplitude-coding optical code division multiple access (SAC-OCDMA) communication system. This work uses single-mode fibre transmission, fibre Bragg grating and quadratic dispersion by considering 40 km long distance scenario. This model helps to reduce the communication delay caused due to interference and distortion. Moreover, this model is obtained by modifying conventional triple-branch signal detection (CBSD) multiuser detection approach.

A huge amount of work has been done in this field of multiple access based communication systems. This section briefly describes various models for CDMA systems. These systems are based on the performance improvement of CDMA system in multiuser detection systems. However, these technique techniques provide better performance but still there is a need to improvise the performance of the CDMA systems. In the next section we present a new approach of multiuser detection for CDMA communication systems system.

Proposed Model

This section deals with proposed approach of multiuser detection for CDMA system. First of all, we present CDMA modelling in this section. In the next phase, multiuser detection is formulated and finally an optimization approach is implemented to fine tune the performance of CDMA system.

Table 1 List of Notations

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Rx(t)$</td>
<td>Received signal</td>
</tr>
<tr>
<td>$S_{orig}(t)$</td>
<td>Original signal</td>
</tr>
<tr>
<td>$n(t)$</td>
<td>Noise</td>
</tr>
<tr>
<td>$\mathcal{M}$</td>
<td>Number of users (multiple users)</td>
</tr>
<tr>
<td>$\mathcal{D}$</td>
<td>Data symbols</td>
</tr>
<tr>
<td>$\tau_k$</td>
<td>Delay,</td>
</tr>
<tr>
<td>$A_k$</td>
<td>Amplitude of the signal</td>
</tr>
<tr>
<td>$b_k$</td>
<td>Symbol stream</td>
</tr>
<tr>
<td>$s_{orig,k}(t)$</td>
<td>Normalized symbol waveform</td>
</tr>
<tr>
<td>$\rho$</td>
<td>LLR probability</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Noise variance</td>
</tr>
<tr>
<td>$G(r)$</td>
<td>Initial population generation</td>
</tr>
<tr>
<td>$G(r + 1)$</td>
<td>Next Generation</td>
</tr>
<tr>
<td>$C(h)$</td>
<td>Objective function for GA optimization</td>
</tr>
<tr>
<td>$(f_i)$</td>
<td>Pre-defined fitness value for GA</td>
</tr>
<tr>
<td>$V_i$</td>
<td>Objective value for $i^{th}$ chromosome</td>
</tr>
<tr>
<td>$V_w$</td>
<td>Worst value of chromosome</td>
</tr>
<tr>
<td>$\beta$</td>
<td>Signal sequence</td>
</tr>
<tr>
<td>$c$</td>
<td>GA optimization constant</td>
</tr>
<tr>
<td>$f_{total}$</td>
<td>Fitness value for all chromosomes</td>
</tr>
<tr>
<td>$p_i$</td>
<td>Chromosome probability</td>
</tr>
</tbody>
</table>

System Model

Here we present the system mode of CDMA communication setup. Let us consider that CDMA system is operating in BPSK modulation. According to this model, received waveforms can be expressed by analyzing the modulated data signal in the additive noise scenario. This can be expressed as given in Eq. (1).
\[ Rx(t) = S_{\text{orig}}(t) + n(t) \]  
(1)

Where \( Rx(t) \) is the received signal, \( S_{\text{orig}}(t) \) denotes original signal and \( n(t) \) denotes the noise present in the signal. In this process of CDMA communication, original signal consists of multiple users in the given channel for multiple users (\( \mathcal{M} \)), it can be expressed as presented in Eq. (2).

\[
S_{\text{orig}}(t) = \sum_{m=1}^{\mathcal{M}} \mathcal{A}_m \sum_{i=0}^{D-1} b_m(i) s_{\text{orig},m}(t - iT - \tau_m)
\]  
(2)

Where \( \mathcal{M} \) denotes total number of users, \( D \) denotes total number of data symbols present in a given communication stream, amplitude of received signal is denoted by \( \mathcal{A}_m \), communication delay is represented by \( \tau_m \), \( b_m \) denotes symbol stream which is given as \( \{b_m(i); i = 0, 1, ..., D - 1\} \) and \( s_{\text{orig},m}(t) \) denotes normalized signal waveform for \( m \)th user given as \( \{s_{\text{orig},m}(t); 0 \leq t \leq T\} \). In this model, it is considered that \( s_{\text{orig},m}(t) \) is always in the range of \([0, T]\) and contains unit energy whereas \( b_k(i) \) is the collection of

\[
r(t) = \sum_{m=1}^{\mathcal{M}} \mathcal{A}_m b_m(i) s_{\text{orig},m}(t - iT) + n(t),
\]

A chip-matched filtering is applied at the receiver end where received signal is filtered first and then based on the chip rate, received signal is sampled. Hence the resulting signal, corresponding to \( j \)th chip of \( i \)th symbol is given as presented in Eq. (5).

\[
r(t) = \int_{iT+(j+1)Tc}^{iT+jTc} r(t) \varphi(t - iT - jTc) dt = \sum_{m=1}^{\mathcal{M}} \mathcal{A}_m b_m(i) s_j^m + n_j(i)
\]  
(5)

In other way, it can be expressed in vector for as given in Eq. (6).

\[
r(t) = \sum_{m=1}^{\mathcal{M}} \mathcal{A}_m b_m(i) s_{\text{orig},m} + n(t)
\]  
(6)

Where

\[
S_{\text{orig},m} \triangleq [s_0^m, s_1^m, ..., s_{\mathcal{N}-1}^m]^T = \frac{1}{\sqrt{\mathcal{N}}} [\beta_0^m, ..., \beta_{\mathcal{N}-1}^m]^T \] known as the normalized signature sequence for \( m \)th communicating user. According to channel modeling, noise is also considered here which is expressed as \( n(t) \triangleq [n_0(i), ..., n_{\mathcal{N}-1}]^T \). It is considered that noise samples are independent and identically distributed using a non-Gaussian distribution model. In this article, we have used Gaussian mixture modelling independent random variable such as it ranges in \( \pm 1 \). To consider multiple-access for direct sequence spread-spectrum the signalling can be expressed as:

\[
S_{\text{orig},m}(t) = \sum_{m=1}^{\mathcal{M}} \beta^m \varphi(t - jTc), t \in [0, T]
\]  
(3)

Where processing of signal waveform is analyzed in terms of processing gain which is denoted by \( \mathcal{N} \), signal sequence for \( k \)th user is denoted by \( (\beta_0^m, \beta_1^m, ..., \beta_{\mathcal{N}}^m) \) which contains data sequence in the form of \( \pm 1 \), normalized chip waveform is denoted by \( \varphi \) and time duration for chip waveform is given by \( T_c \). Processing gain, chip waveform duration and total time duration has a relationship such as \( \frac{T}{T_c} = \mathcal{N} \). In this work, our main aim is to develop a robust approach for multiuser detection for improving the performance of CDMA systems by considering synchronous CDMA systems where \( (\tau_1 = \tau_2 = ... = \tau_{\mathcal{M}} = 0) \). In order to consider the synchronous model, demodulation of \( i \)th symbol for \( \mathcal{M} \) users helps to model the received signal during signaling interval. This can be expressed as given in Eq. (4).

\[
t \in [iT, (i + 1)T]
\]  
(4)

for noise consideration. Hence the probability density function of noise can be given as follows;

\[
f = (1 - \varepsilon)\delta((0, \sigma^2)) + \varepsilon\delta(0, \mathcal{X}v^2)
\]  
(7)

Where value of \( \sigma > 0 \), \( 0 \leq \varepsilon \leq 1 \) and \( \mathcal{X} \geq 1 \). Background noise is termed as \( \delta((0, \sigma^2)) \) and impulsive component is expressed as \( \delta(0, \mathcal{X}v^2) \). Noise variance model is given as

\[
\sigma^2 \triangleq (1 - \varepsilon)\sigma^2 + \varepsilon\mathcal{X}v^2
\]  
(8)

This complete model is used to represent the CDMA communication model for multiuser detection. Based on this model, multiuser detection technique is applied which helps to improve the communication performance for end-user experience by reducing bit error rate.

### B. Proposed Solution for Multiuser Detection

This work mainly concentrates on the multiuser detection scheme for CDMA system. To carry out this work, we have utilized Monte Carlo approach for obtaining the solution for considered CDMA multiuser detection problem. Proposed solution uses Markov chain modelling for CDMA application scenario. Here a Bayesian problem is considered for multiuser detection. Let us consider that for given asynchronous CDMA system, observed data signal is denoted as \( S \triangleq \{s_1, s_2, ..., s_n\} \) where main aim is to compute the
unknown parameters i.e. multiuser detection quantities denoted as \( X = \{x_1, x_2, ..., x_m\} \). Generally, \( S \) is the solution of parameter \( X \) along with some noise denoted as \( \mathbf{n} = \{n_1, n_2, ..., n_m\} \). Bayesian technique is employed for multiuser detection in CDMA communication systems.

According to the working of Bayesian technique, a statistical signal processing problem is formulated where unknown variable which are required for multiuser detection are considered as a randomly distributed variables with a prior random distribution. This distribution is given as \( p(S, \mathbf{n}) \). Using this, joint posterior distribution, Bayesian inference for unknown variables can be defined as follows:

\[
p(X, \mathbf{n}|S) \propto p(S|\mathbf{n}, X)p(S, \mathbf{n})
\]  

(9)

This computation about joint posterior distribution can be computed to a limited normalized constant. In case of CDMA system, multiple users are present during communication hence for \( i^{th} \) component the i.e. \( x_i \) of \( X \) so need to compute \( E(h(x_i)|S) \) for given function. This can be computed as given in Eq. (10).

\[
E(h(x_i)|S) = \int h(x_i)p(x_i|S)dx_i
= \int h(x_i) \int p(X, \mathbf{n}|S)dx_{[i-1]}d\mathbf{n}dx_i
\]  

(10)

This complete Bayesian modelling is used for multiuser detection for CDMA applications. This technique helps to develop an adaptive approach for blind multiuser detection for a coded CDMA system. Block diagram of this process is depicted in figure 1 where various components are utilized to construct the CDMA model such as channel encoder, interleaver, symbol mapper etc.

For this coded CDMA system, input data bits are given in binary format denoted as \( d_{k,t} \). This information bit is denoted for \( k^{th} \) communicating user and constructed with the help of channel codes i.e. convolution code, turbo code or block code. This process helps to generate a coded bit stream for communication. During decoding process at the input point of communicating channel, so error is induced into original signal. In order to reduce the error effect, interleaver is used resulting in error reduction in original data and improvement in communication performance. These data bits are known as interleaved coded data bits which are mapped into a binary symbol and symbol stream is generated which is denoted by \( \{b_{k,t}\} \). In next stage, modulation is applied on the given data symbols and transmitted through a channel where received signal is expressed as given in Eq. (4).

In next stage, data is received at the receiver where bit-streams are decoded for each user. In this work, a turbo decoder receiver architecture is considered which gives a significant performance by iterating multiuser detection stage and data decoding stage resulting in better performance of multiuser detection and bit error rate reduction. This type of architecture is widely utilized in this type of application. Turbo receiver architecture is depicted in figure 2.

The complete architecture of Turbo detector is a combination of two stages: Bayesian multiuser detector and maximum a posterior probability channel decoder. These stages are categorized and portioned using deinterleaver and interleaver modules. During simulation, posterior probabilities are computed by Bayesian multiuser detector which is expressed as \( \{P[x_{k,t} = +1|S]\}_{k,t} \). With the help of this probabilities log-likelihood computed for each transmitted symbol.

This can be computed as:

\[
\rho[x_{k,t}] \triangleq \log \frac{P[x_{k,t} = +1|S]}{P[x_{k,t} = -1|S]}
\]  

(11)

This ratio includes both \( +1 \) and \( -1 \) symbols for computation of probability. By applying Bayesian model to this, it can be rewritten as

\[
\rho[x_{k,t}] = \log \frac{P[S|x_{k,t} = +1]}{P[S|x_{k,t} = +1]} + \log \frac{P[x_{k,t} = +1]}{P[x_{k,t} = +1]}
\]  

(12)

Second term of equation (12) denotes a priori log likelihood ratio of input coded bit. This computation is performed at channel decoder module for each iteration and outcome of this is parsed to the Bayesian multiuser detector whereas first term denotes total information
delivered by Bayesian network which is computed based on the received signal information.

From this discussion it can be concluded that computation of a posterior probability of data symbols plays an important role as per the performance aspect in turbo multiuser receiver or detector. Any prior information is not known to any of the user due to that receiver is named as blind.

In order to solve this problem, here we use evolutionary computation algorithm. To our best knowledge, Genetic Algorithm provides better and optimal solutions for any given optimization problem. Here we consider a posterior probability as an optimization problem and derive an efficient solution for this problem.

C. Genetic Algorithm

In this section, a brief discussion about genetic algorithm is presented. This technique is derived from the natural processes. General process of this technique is given as follows:

a. Generation of initial random population
b. Computation of objective functions for generated population
c. Fitness value computation for generated population
d. Creation of new population using crossover and mutation schemes.
e. Evaluation of objective function and fitness for the new population
f. If optimal criteria are obtained, then stop the process otherwise re-compute from step (d).

In this process of genetic algorithm, population is considered as a set of various chromosomes denoted as $G(r)$. These chromosomes are encoded to obtain the possible optimal solution. Encoding is applied for each newly generated population as given in step (d) where crossover and mutation helps to generate the new population. This complete population and their solutions are stored in the binary vector format. A general block diagram of Genetic Algorithm is presented in figure 3.

![Genetic Algorithm Flowchart](image)

**Figure 3 Genetic Algorithm Flowchart**

For best solution, fitness function is computed with the help of objective function computation. In this work, our main objective function is considered as computation of $C(b)$ for multiuser detection process. Selection process of best solution depends on their fitness value, best fitness chromosomes are selected for generation of new population using crossover and mutation process.

For CDMA multiuser detection process, window mapping and impartial selection technique is adopted here. According to this technique, each chromosome is assigned with a pre-defined fitness value ($f_i$). Given as

$$f_i = |V_i - V_w| + c$$  \[13\]

Where $V_i$ denotes the objective value of $i^{th}$ chromosome and $V_w$ denotes the objective value for worst chromosome and $c$ is the GA (Genetic Algorithm Constant). After computing fitness value for all chromosome, best fit value or chromosome can be computed by using bet-fittest law. Let us consider that sum of fitness value of all chromosomes is given $f_{total}$ then the probability of being parent of chromosome can be computed as:

$$p_i = \frac{f_i}{f_{total}}$$  \[14\]

In this process of Genetic Algorithm, crossover and mutation play crucial role for chromosome selection. According to crossover technique, substrings of two parents are combined and two new offsprings are generated as chromosomes. In this work we focus of multiuser detection by applying genetic algorithm where in chromosome stage require the location of chromosome at a crossover site. On other hand, mutation is used to induce the variation in chromosome based on the given chromosome probability. At this stage, probability test is applied on given chromosome and if the probability test is passed then only bits will change otherwise it remains same. In each iteration of genetic approach, a new population $G(r + 1)$ is generated. If the newly generated population has higher value of fitness then genenration is replaced by new generation. This completer process is performed iteratively until the best optimal solution interns of chromosomes or population is obtained. Based on this model, we present some experimental study for multiuser detection for CDMA communication system.
Overall algorithm of proposed model is depicted below:

<table>
<thead>
<tr>
<th>Phase I: CDMA Model Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1:</strong> Consider BPSK modulation scheme and construct a signal reception model $R_x(t) = S_{orig}(t) + n(t)$ with channel noise parameters as given in (1).</td>
</tr>
<tr>
<td><strong>Step 2:</strong> Consider $(M)$ number of multi-users and represent original signal model as given in (2).</td>
</tr>
<tr>
<td><strong>Step 3:</strong> Original signal must be normalized in the range of $s_{orig,m}(t); 0 \leq t \leq T$ with random variable collection.</td>
</tr>
<tr>
<td><strong>Step 4:</strong> Construct a spread-spectrum signal model as given in (3).</td>
</tr>
<tr>
<td><strong>Step 5:</strong> Apply chip-matched filtering to model the final received signal at receiver end with the help of consideration of Processing gain, chip waveform duration and total time duration.</td>
</tr>
<tr>
<td><strong>Step 6:</strong> Normalize the signal into various data samples and express it in a vector form as given in (6).</td>
</tr>
<tr>
<td><strong>Step 7:</strong> Define probability density function and noise variance model.</td>
</tr>
</tbody>
</table>

**Phase II: Bayesian model development for multi-user detection**

**Step 9:** Construct a joint posterior distribution Bayesian interference for unknown variables of multi-user as $p(X, n|S) \propto p(S|n, X)p(S, n)$, expressed in (9).

**Step 10:** Turbo detector modeling using Bayesian multi-user detector and posterior probability channel decoder.

**Step 11:** Compute the probabilities of Bayesian multiuser detector $\{P[x_{k,t} = +1|S]\}_{k,t}$.

**Step 12:** Compute log-likelihood measurement of each symbol as given in (11).

**Step 13:** Find a priori log likelihood ratio of input coded bits whose first term denotes the complete information of the signal based on Bayesian network.

**Step 14:** Construct optimization problem using a posterior probability functions.

**Phase III: Genetic Algorithm optimization**

**Step 15:** Generation of initial random population.

**Step 16:** Computation of objective functions for generated population.

**Step 17:** Fitness value computation for generated population.

**Step 18:** Creation of new population using crossover and mutation schemes.

**Step 19:** Evaluation of objective function and fitness for the new population.

**Step 20:** If optimal criteria are obtained, then stop the process otherwise re-compute from step (18).

**RESULT AND DISCUSSION**

Complete experimental study and result analysis is presented in this section. Considered simulation parameters are presented in table 2.

**Table 2 Simulation Parameters**

<table>
<thead>
<tr>
<th>Simulation Parameter</th>
<th>Considered Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Rx Antenna</td>
<td>Rx=1,3,5</td>
</tr>
<tr>
<td>Spreading Sequence</td>
<td>Random</td>
</tr>
<tr>
<td>Modulation Scheme</td>
<td>QPSK and 16-QAM</td>
</tr>
<tr>
<td>Number of mobile users</td>
<td>30</td>
</tr>
<tr>
<td>SNR value consideration</td>
<td>0:30 dB</td>
</tr>
<tr>
<td>Channel State information</td>
<td>Not known</td>
</tr>
<tr>
<td>Number of Paths</td>
<td>3</td>
</tr>
<tr>
<td>Spreading gain</td>
<td>32</td>
</tr>
</tbody>
</table>

For performance analysis of proposed approach, we have simulated proposed approach using MATLAB simulation tool for varied test cases. According to given table 2, number of receiver antennas are varied from 1 to 5. Since the CDMA scheme uses spreading process on the given data, here Random spreading is applied for performance analysis. CDMA communication system require modulation scheme for efficient data transmission hence QPSK and 16-QAM modulation models are used in this work. Similarly, here we have used genetic algorithm for optimization. Hence table 3. Shows the parameters for genetic algorithm considered in this work.

**Table 3 Genetic Algorithm Parameters**

<table>
<thead>
<tr>
<th>Simulation Parameter</th>
<th>Considered Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of population</td>
<td>100</td>
</tr>
<tr>
<td>Size of chromosome</td>
<td>200</td>
</tr>
<tr>
<td>Maximum number of generations</td>
<td>20</td>
</tr>
<tr>
<td>Crossover probability</td>
<td>0.9</td>
</tr>
<tr>
<td>Mutation probability</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Initial population size is taken as 100. This population is used to generate the next population where set of chromosomes is considered with the size of 200 chromosomes in each set. This process is simulated for maximum 20 number of generations with crossover probability as 0.9 and mutation probability as 0.8. In order to analyze the performance, Bit Error Rate is
computed and compared with other state-of-art algorithms. First experimental study is carried out for 2 transmitter and 2 receiver antennas for 1000 Monte Carlo simulation iterations. The performance is measured in terms of bit error rate for a given SNR (Signal to Noise Ratio) range. Proposed approach is compared with conventional MMSE scheme.

![Figure 4 BER Vs SNR Performance Comparison for 2 Transmitter and Receiver Scenario](image)

According to figure 4, average value of obtained are as 0.39, 0.36 and 0.32 using MMSE, NLMS and proposed approach for multiuser detection. Similarly, we simulate proposed approach for 3 transmitter and receiver set of antennas. Comparative performance is presented in figure 5.

![Figure 5 BER Vs SNR Performance Comparison for 3 Transmitter and Receiver Scenario](image)

Figure 5 shows a comparative study of multiuser detection for 3 transmitters and 3 receiver scenarios for CDMA communication system. Average bit error is obtained using these three approaches is 0.18,0.16 and 0.14 for MMSE, NLMS and proposed technique respectively.

![Figure 6 Average BER Performance](image)

Finally, average BER performance is depicted in figure 6 and a comparison is presented by considering MMSE, NLMS and proposed approach. This comparison shows that proposed approach obtains better performance when compared with state-of-art techniques. Furthermore, we present a comparative study as depicted in figure 7.

![Figure 7 SER vs SNR Performance](image)

In order to show more robust performance of proposed approach, we considered recent schemes of CDMA as given in Peixoto (2017) where Non-cooperative, Cooperative, Zero-forcing, Tensor based CDMA schemes are discussed. Performance is measured in terms of symbol error rate.

**CONCLUSION**

An improved approach of multiuser detection for asynchronous CDMA systems is presented in this article. The proposed approach uses Bayesian computation model and Monte Carlo iterative approach for problem formulation and analysis the required step to be followed. Moreover, a log likelihood ratio is also computed for to estimate the probability of user detection during simulation stage. Here, we have considered a posterior probability as an optimization problem for CDMA communication systems and presented an evolutionary computation model for multiuser detection. This technique is based on Genetic Algorithm which is adopted here for probability optimization. According to this approach, mutation and crossover modules are applied for finding best solution for optimization problem. This is an iterative process until the optimal solution is obtained. Experimental study shows that proposed approach provides better performance when compared with existing MMSE and NLMS schemes for multiuser detection.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** - Nil

**REFERENCES**


A Study on the Mediating Effect of Self-Regulation Ability in Nursing Student’s Perfectionism and Social Problem-Solving Relationship

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Abstract

Background/Objectives: The purpose of this study was to check up whether the self-regulation ability of nursing student has a mediating effect on the perfectionism and social problem-solving relationship.

Methods/Statistical analysis: Participants were 145 nursing students from B city. The data were collected using a structured questionnaire consisting of three instruments: Multidimensional Perfectionism Scale (MPS), Social Problem-Solving Inventory-Revised (SPSI-R), Volitional Components Inventory (VCI). The data were analyzed by descriptive statistics, Pearson correlation analysis and multiple linear regression using SPSS 24.0 program.

Findings: The level of perfectionism was 3.04 ± 0.40, the level of social problem-solving was 3.22 ± 0.31, and the self-regulation ability level was 2.51 ± 0.34. The degree of Perfectionism was positively correlated with self-regulation ability (r=.20, p=.016) and social problem–solving (r=.47, p<.001). Also, Self-regulation ability partially mediated the relationship with perfectionism and social problem–solving.

Improvements/Applications: Self-regulation ability plays an important mediating role in social problem–solving of nursing students with perfection tendency. Therefore, Self-regulation ability should be reflected in planning a program to strengthen the social problem-solving of nursing students

Keywords: Mediating Effect, Perfectionism, Self-Regulation Ability, Social Problem–Solving, Nursing, Students

Introduction

Nursing students are required to have a strong sense of responsibility because of their academic characteristics that deal with the lives of human beings, and due to the preparation for national licensing examinations, they have greater burden of learning and spend longer time on studying compared to other majors. In particular, they are required to complete a curriculum that includes more than 1,000 hours of practical training and studying at various clinical sites [1], and also to become nurses with an ability to adapt to work immediately after graduation. Clinical sites have recently shown drastic changes in the medical environment, such as increasing utilization of advanced medical equipment, increase of chronic diseases and serious illnesses due to aging of population, and occurrence of new infectious diseases from time to time. Such environmental changes have created a mood for nurses to be more fully inclined to perfectionism, which does not tolerate mistakes and requires a high level of clinical nursing performance and a variety of problem-solving abilities. For this reason, they are required to gain such inclinations as nursing students. In fact, perfectionism of nursing students was higher than normal [2,3] and nurses showed even higher inclination for perfectionism [4].

Perfectionism is a positive aspect that increases self-esteem and self-satisfaction when pursuing realistic and reasonable standards. However, if it is too high, it can show negative aspects such as anxiety, depression, and fear of failure. For some nurses, perfectionism was found to be a cause of negative stress that leads to burnout from nursing [5,6]. In addition, since younger
nurses have greater tendency to pursue perfectionism and increasing inclination for perfectionism is associated with low satisfaction with the nursing profession [4], perfectionism needs to be controlled. Also people who seek perfectionism tend to worry about negative consequences or mistakes in their performance, and are overly concerned with the evaluation of others, and students with high perfectionism tens to have low academic exhaustion [7]. Therefore, nursing students must control their perfectionism because excessive inclination for perfectionism against negative consequences may influence their academic and practical experiences. Also, it is necessary to study the mediating factors that can control inclination of nursing students for perfectionism to increase job satisfaction without causing job burnout as nurses in the future. People with strong self-control ability are emotionally stable, have high self-esteem, and can form healthy interpersonal relationships. Self-regulation is the process of controlling conditions and functions of oneself, referring to ability to change and adapt oneself to create an optimal situation between self and the outside [8]. Consequently, the purpose of this study is to check up whether the self-regulation abilities of nursing students have a mediating effect on perfectionism and social problem-solving ability relationship.

METHOD

Study Design

This was a cross-sectional descriptive study that confirmed mediating role of self-regulation ability in perfectionism and social problem-solving relationship of nursing students, as illustrated in [Figure 1].

![Figure 1: Conceptual Framework](image)

Participants

The subjects of this study were selected by random sampling among students attending the nursing department at a university in B city who voluntarily decided to participate and agreed in writing. As a result of calculating the suitable sample size with the G*Power 3.0 program, based on effect size of .15 for the multiple regression analysis, significance level of .05, power of .95 and two independent variables, minimum sample size required was found to be 107 persons. A total of 150 questionnaires were distributed considering the drop-out rate, and 145 questionnaires were finally used for the analysis after excluding 5 inadequate responses.

Instruments

Perfectionism

Perfectionism of nursing students in this study was measured by the Multidimensional Perfectionism Scale [9]. Multidimensional Perfectionism Scale (MPS) is a total of 35 items. These are subsumed to the following six subscales: Concern over Mistakes, Personal Standards, Parental Expectations, Parental Criticism, Doubts about Actions and Organization. Each item has a 5-point Likert scale, which means that the higher the score, the higher the perfection tendency. The MPS in this study has a reliability of Cronbach’s α = .84.

Social problem solving

Social problem-solving ability was assessed by the Social Problem-Solving Inventory-Revised [10]. Social Problem-Solving Inventory-Revised (SPSI-R) contains a 52-item questionnaire. The SPSI-R consists of five major scales: Positive Problem Orientation (PPO), Negative Problem Orientation (NPO), Rational Problem Solving (RPS), Impulsivity-Carelessness Style (ICS) and Avoidance Style (AS). Each item has a 5-point Likert scale, with high scores indicating better the problem-solving ability. The SPSI-R in this study has a reliability of Cronbach’s α = .81.

Self-regulation ability

To measure Self-regulation ability, Volitional Components Inventory [11] was used. Volitional Components Inventory (VCI) contains a total of 21 items. The VCI has two sessions: Self-control form 10 items, and volitional self-inhibition form 11 items. Each item has a 4-point Likert scale. High scores indicate that self-regulation is better. The VCI in this study has a reliability of Cronbach’s α = .77.

Data Analysis

The data collection period was from May 1, 2017 to May 30, 2017. Before collecting the data, the researcher explained that the participants may decide to withdraw
at any time. It took about 10-15 minutes to complete the questionnaire. The collected data were analyzed using the SPSS 24.0 program as follows. General characteristics of the subjects were analyzed by frequencies, percentages, means and standard deviations. Means and standard deviations were calculated to determine the nursing student’s level of perfectionism, social problem-solving and self-regulation ability. The t-test or one-way analysis of variance and Scheffe’s test were utilized to analyze differences in the levels of perfectionism, social problem-solving, and self-regulation ability based on general characteristics of the subjects. Pearson’s correlation analysis was used to determine the relationship between perfectionism, social problem-solving ability, and self-control ability of the subjects. The multiple regression analysis suggested by Baron and Kenny \cite{12} was used to test the mediating effect of self-regulation ability in perfectionism and social problem-solving ability relationship. The Sobel test was performed to confirm the significance of the mediation effect and coefficient.

**Results and Discussion**

**General characteristics of the subjects**

Among 145 subjects of this study, 84.8% were female and 15.2% were male. The ratios of grades were 33.8% for freshmen, 26.9% for sophomores, 17.2% for juniors and 22.1% for seniors. 52.4% of the subjects had a clinical practice experience and 47.6% did not have a clinical practice experience [Table 1].

**Table 1: General Characteristics of the subjects**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>22 (15.2)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>123 (84.8)</td>
</tr>
<tr>
<td>Grade</td>
<td>Freshman</td>
<td>49 (33.8)</td>
</tr>
<tr>
<td></td>
<td>Sophomore</td>
<td>39 (26.9)</td>
</tr>
<tr>
<td></td>
<td>Junior</td>
<td>25 (17.2)</td>
</tr>
<tr>
<td></td>
<td>Senior</td>
<td>32 (22.1)</td>
</tr>
<tr>
<td>Clinical practice experience</td>
<td>Yes</td>
<td>76 (52.4)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>69 (47.6)</td>
</tr>
</tbody>
</table>

**Degree of perfectionism, social problem-solving and self-regulation ability in the subjects**

The level of perfectionism was 3.04±0.40. The levels of perfectionism reported by nursing students in this study were lower than those reported previously \cite{3}. Sub categories of perfectionism were found in the order of organization (3.38±0.58), parental expectations (3.20±0.66), doubts about actions (3.19±0.67), personal standards (3.14±0.57), concern over mistakes (3.01±0.57) and parental criticism (2.29±0.68). The score on social problem-solving of nursing students in present study was 3.21±0.31, similar to that reported in a previous study \cite{13}. Sub scales of social problem-solving were reported in order of positive problem orientation (3.57±0.55), rational problem-solving (3.50±0.43), negative problem orientation (3.12±0.75), impulsivity-carelessness style (2.87±0.55) and avoidance style (2.84±0.73). The score on self-regulation ability was 2.51±0.34. Sub categories were found in the order of volitional self-inhibition form (2.55±0.41) and self-control form (2.47±0.47) [Table 2].
Table 2: Degree of Perfectionism, Social Problem-Solving and Self-Regulation Ability in Nursing Students (N=145)

<table>
<thead>
<tr>
<th>Variables</th>
<th>M±SD</th>
<th>Min</th>
<th>Max</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfectionism</td>
<td>3.04±0.40</td>
<td>2.06</td>
<td>3.97</td>
<td>1-5</td>
</tr>
<tr>
<td>Concern over mistakes</td>
<td>3.01±0.57</td>
<td>1.50</td>
<td>4.40</td>
<td>1-5</td>
</tr>
<tr>
<td>Personal standards</td>
<td>3.14±0.57</td>
<td>1.80</td>
<td>4.80</td>
<td>1-5</td>
</tr>
<tr>
<td>Parental expectations</td>
<td>3.20±0.66</td>
<td>1.50</td>
<td>4.75</td>
<td>1-5</td>
</tr>
<tr>
<td>Parental criticism</td>
<td>2.29±0.68</td>
<td>1.00</td>
<td>4.00</td>
<td>1-5</td>
</tr>
<tr>
<td>Doubts about actions</td>
<td>3.19±0.67</td>
<td>1.75</td>
<td>5.00</td>
<td>1-5</td>
</tr>
<tr>
<td>Organization</td>
<td>3.38±0.58</td>
<td>2.00</td>
<td>5.00</td>
<td>1-5</td>
</tr>
<tr>
<td>Social problem-solving</td>
<td>3.21±0.31</td>
<td>2.65</td>
<td>4.31</td>
<td>1-5</td>
</tr>
<tr>
<td>Positive problem orientation</td>
<td>3.57±0.55</td>
<td>2.00</td>
<td>5.00</td>
<td>1-5</td>
</tr>
<tr>
<td>Negative problem orientation</td>
<td>3.12±0.75</td>
<td>1.20</td>
<td>5.00</td>
<td>1-5</td>
</tr>
<tr>
<td>Rational problem-solving</td>
<td>3.50±0.43</td>
<td>2.35</td>
<td>5.00</td>
<td>1-5</td>
</tr>
<tr>
<td>Impulsivity-carelessness style</td>
<td>2.87±0.55</td>
<td>1.30</td>
<td>4.20</td>
<td>1-5</td>
</tr>
<tr>
<td>Avoidance style</td>
<td>2.84±0.73</td>
<td>1.00</td>
<td>5.00</td>
<td>1-5</td>
</tr>
<tr>
<td>Self-regulation ability</td>
<td>2.51±0.34</td>
<td>1.70</td>
<td>3.50</td>
<td>0-4</td>
</tr>
<tr>
<td>Self-control form</td>
<td>2.47±0.47</td>
<td>1.00</td>
<td>3.70</td>
<td>0-4</td>
</tr>
<tr>
<td>Volitional self-inhibition form</td>
<td>2.55±0.41</td>
<td>1.64</td>
<td>3.36</td>
<td>0-4</td>
</tr>
</tbody>
</table>

**Degree of perfectionism, social problem-solving and self-regulation ability according to general characteristics**

Statistically significant differences weren’t founded in degree of perfectionism according to sex (t=-0.57, p=.570), grade (F=1.02, p=.387) and clinical practice experience (t=0.967, p=.357).

Social problem-solving of the subjects showed significant differences according to grade (F=6.86, p<.001) and sex (t=-2.08, p=.039). Juniors had higher score on problem-solving than freshmen, sophomores and seniors. Female nursing students had higher score on social problem-solving than male students. This was different from the previous study in which there was no statistically significant difference in social problem solving according to general characteristics such as gender and grade of the subjects [13].

Self-regulation ability of the subjects showed significant differences according to clinical practice experience (t=2.26, p=.026). Students with a clinical practice experience had higher score on self-regulation ability [Table 3].
Table 3: Differences in Perfectionism, Social Problem-Solving and Self-Regulation Ability by General Characteristics (N=145)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Perfectionism</th>
<th>Social Problem-Solving</th>
<th>Self-Regulation Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M±SD</td>
<td>t or F (p)</td>
<td>M±SD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scheffe</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>3.00±0.36</td>
<td>-0.57 (.570)</td>
<td>3.10±0.30</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3.05±0.41</td>
<td></td>
<td>3.25±0.30</td>
</tr>
<tr>
<td>Grade</td>
<td>Freshman</td>
<td>2.98±0.35</td>
<td>1.02 (.387)</td>
<td>3.14±0.25</td>
</tr>
<tr>
<td></td>
<td>Sophomore</td>
<td>3.09±0.37</td>
<td></td>
<td>3.19±0.26&lt;.001</td>
</tr>
<tr>
<td></td>
<td>Junior</td>
<td>3.13±0.47</td>
<td></td>
<td>3.45±0.39</td>
</tr>
<tr>
<td></td>
<td>Senior</td>
<td>3.00±0.44</td>
<td></td>
<td>3.22±0.30</td>
</tr>
</tbody>
</table>

Correlation among perfectionism, social problem-solving and self-regulation ability of the subjects

Based on the analysis of the correlation among perfectionism, social problem-solving and self-regulation ability of nursing students, perfectionism positively correlated with self-regulation ability (r=.20, p=.016) and social problem-solving (r=.47, p<.001). Also, it appeared that there was a significant positive correlation between social problem-solving and self-regulation ability (r=.33, p<.001) [Table 4].

Table 4: Correlation among Perfectionism, Social Problem-Solving and Self-Regulation Ability in Nursing Students (N=145)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Perfectionism</th>
<th>Self-Regulation Ability</th>
<th>Social Problem-Solving</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r (p)</td>
<td>r (p)</td>
<td>r (p)</td>
</tr>
<tr>
<td>Perfectionism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Regulation Ability</td>
<td>.199 (.016)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Social Problem-Solving</td>
<td>.474 (&lt;.001)</td>
<td>.333 (&lt;.001)</td>
<td>1</td>
</tr>
</tbody>
</table>

Mediating effect of self-regulation ability in perfectionism and social problem-solving relationship of the subjects

The mediating effect verification procedure based on the regression analysis proposed by Baron and Kenny [12] and the Sobel test were used to verify the mediating effect of self-regulation ability. In the three-step mediated regression analysis of Baron and Kenny [12], the first step is to perform regression analysis of a mediating variable about an independent variable. The second step is to perform regression analysis of a dependent variable about the independent variable. The last step is to perform
regression analysis of the dependent variable about the independent variable and mediating variable at the same time. The results of the mediated regression analysis are as presented in Table 5. In the first step, perfectionism, the independent variable, showed a statistically significant effect on self-regulation ability, the mediating variable ($\beta=.20, p=.016$). In the second step, perfectionism, the independent variable, showed a statistically significant effect on social problem-solving, the dependent variable ($\beta=.47, p<.001$). In the last step, when perfectionism, the independent variable, was controlled, self-regulation ability, the mediating variable, showed a statistically significant effect on social problem-solving ability, the dependent variable ($\beta=.25, p=.001$). The effect of perfectionism, the independent variable, on social problem solving was statistically significant with a $\beta$ value of .42 ($p<.001$). This value was smaller than the $\beta$ value (.47) found in the second step, confirming a partial mediating effect of self-regulation ability. The Sobel test was performed to verify significance of mediation effect coefficient, an indirect effect of perfectionism, the independent variable, on social problem-solving, the dependent variable, mediated by self-regulation ability, the mediating variable. The coefficient value of 1.98 was statistically significant ($p=.048$) [Table 5].

Table 5: Mediating Effect of Self-Regulation Ability on Nursing Student’s Perfectionism and Social Problem-Solving Relationship (N=145)

<table>
<thead>
<tr>
<th>Step</th>
<th>Predictors</th>
<th>$\beta$</th>
<th>t($p$)</th>
<th>$R^2$</th>
<th>F($p$)</th>
<th>Sobel test</th>
<th>$Z$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>P$\rightarrow$SRA</td>
<td>.199</td>
<td>2.433 (.016)</td>
<td>.400</td>
<td>5.918 (.016)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>P$\rightarrow$SPS</td>
<td>.474</td>
<td>6.434 (&lt;.001)</td>
<td>.225</td>
<td>41.400 (&lt;.001)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SRA$\rightarrow$SPS</td>
<td>.249</td>
<td>3.434 (.001)</td>
<td>.284</td>
<td>28.157 (&lt;.001)</td>
<td>1.98</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P$\rightarrow$SPS</td>
<td>.424</td>
<td>5.854 (&lt;.001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P=Perfectionism; SRA=Self-Regulation Ability; SPS=Social Problem-Solving

**Conclusion**

This study was carried out to identify the degree of perfectionism, social-problem solving and self-regulation ability in nursing university students and to check up the mediating role of self-regulation ability on the relationship between perfectionism and social problem-solving. The results showed that self-regulation ability partially mediated on the relationship between perfectionism and social problem-solving in nursing students. Based on the results of present study, it seems necessary to come up with a program that focuses on reinforcing self-regulation ability of nursing students to improve their social problem-solving. The meaning of this study is in inquiring the relationship among perfectionism, social problem-solving and self-regulation ability, which has not been studied in the past. Future studies are required to examine in different participants or compare the relationship among the variables in clinical nurses.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** - Nil

**References**


Physical and Psychological Factors Contributing to Married Women’s Quality of Life Depending on their Status of Employment or Unemployment

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Abstract

Background/Objectives: This descriptive research study examined the 2016 Korea National Health and Nutrition Examination Survey (KNHANES) data to identify the QOL (Quality of life) of married women.

Methods/Statistical analysis: Of the 8,150 respondents who participated in the 2016 KNHANES, 2,893 married women who clearly indicated ‘yes’ for the questionnaire item inquiring about married were included in the study. Collected data were processed with IBM SPSS 21.0 to generate a complex sample design file for analysis factors influencing QOL of married women.

Findings: The results are as follows. QOL of married women with job were different according to education level, number of family, sleeping hours, depression, subjective health status. The explanatory power was 33.7% (F = 4.45, p < .001). QOL of married women with no-job were different according to education level, economic status, Whether the weight change for 1 year, breakfast frequency, subjective body awareness, depression, subjective health status. The explanatory power was 46.6% (F = 5.85, p < .001).

Improvements/Applications: Results indicate that there is a need to give comprehensive consideration to the factors identified in this study when designing interventions and management plans to promote QOL in married women.

Keywords: Quality of Life, Women, Physical Factor, Psychological Factor, Employment

Introduction

Being a married woman has many aspects: one’s life as a human being, as a person with the gender role of a woman, and as an objective state of being married, which refers to one’s life as a member of a family, the basic unit of society¹. Today, women’s QOL no longer simply the problem of women themselves; it is a family and a societal problem as well²-³. Thus, careful attention should be given to this subject matter. As the employment of married women is increasing in recent years, there is growing interest in the overall life satisfaction and quality of life of married women with respect to their family and workplace¹. Although married women’s increased employment has resulted in a rise in their social activities, they are still expected to take on many responsibilities, such as childcare, childrearing, and household chores, and this persisting phenomenon threatens their quality of life. In this regard, employed married women experience a variety of practical problems, such as role overload and childrearing difficulty, while making their best efforts to fulfill family and work responsibilities¹. Yoon⁴ reported that unemployed housewives have a higher quality of life, which demonstrates that employed married women’s quality of life is under threat. It has been reported that employed married women in Korea have a lower quality of life and family life satisfaction compared with their Han Chinese Koreans in China) counterparts⁵. The factors that directly deteriorate Korean married women’s quality of life included tensions with in-laws, sense of inferiority in comparison with others, lost existential meaning of their self, strained relationship with
their husband who look down on them, fatigue from household chores, and a lack of thoughtfulness from neighbors and family members. This study by Kim et al. on the quality of life of married women in Korea, however, did not consider the married women’s status of employment or unemployment, which is thought to have a significant effect on their quality of life. While there have been many studies on married women’s quality of life, few have examined their quality of life depending on whether they are employed or unemployed. In this context, this study was conducted to examine any difference in married women’s quality of life depending on whether they were employed or unemployed. In this context, this study was conducted to examine any difference in married women’s quality of life depending on whether they were employed or unemployed using representative data from the Korea National Health and Nutrition Examination Survey (KNHANES), and to present a basic reference for improving the quality of life of employed or unemployed married women.

**Method**

**Design**

This descriptive study performed a secondary analysis on data from the first year of the 7th KNHANES in 2016 to compare the factors contributing to the quality of life of employed and unemployed married women.

**Subjects**

This study examined 2,893 married women who clearly responded to their status of employment or employment out of 8,150 participants in the 2016 KNHANES.

The KNHANES was conducted with approval from Statistics Korea and the Institutional Review Board (IRB) in the Korea Centers for Disease Control and Prevention. The participants filled out a consent form before participating in the survey.

**Variables**

The KNHANES consists of an examination survey, a questionnaire survey, and a nutrition survey, and is a survey required by law; it aims to produce statistics with representation and reliability at the national level on Koreans’ health status, perception and behavior related to health, and status of food and nutrition consumption. In particular, statistical data are used to set targets and evaluate indicators in the Health Plan (HP), and they are used as a basic reference required in developing health programs as well as in establishing and evaluating health policies.

- The general characteristics included age, economic status, education level, number of household members, weight change over the past one year, weight control over the past one year, sleeping hours, frequency of breakfast per week, frequency of lunch per week, frequency of dinner per week, frequency of eating out per week, and quality of life. Age was divided into the age brackets of 30-39, 40-49, and 50-59; economic status into lower, middle-lower, middle-upper, and upper class; education level into elementary school graduation or lower, middle school graduation, high school graduation, and college graduation or higher; number of household members into one, two to three, and four or more; sleeping hours into six hours or less, seven to eight hours, and nine hours or more; frequency of breakfast, lunch, and dinner per week into three times or more and two times or less; and frequency of eating out into five times or more per week, one to four times per week, and three times or less per month. EQ-5D (EuroQol-5Dimensions) was used for the quality of life.

- Physical factors included hypertension, diabetes, medical check-up, drinking, smoking, number of hours spent sitting, body mass index (BMI), number of walking exercise days per week, and number of strength exercise days per week. High blood pressure and diabetes were divided into diagnosed and not diagnosed; number of hours spent sitting into four hours or less, five to eight hours, and nine hours or more; BMI into lower than 18.5, 18.5–24.9, and higher than 25; and number of walking exercise days and strength days per week into two days or less and three days or more.

- Psychological factors included depression, stress, subjective body image, and subjective health. Depression was divided into diagnosed and not diagnosed; stress into “I feel it very much” and “I do not feel it at all”; subjective body image into slim, normal, and overweight; and subjective health into good, normal, and bad.

**Data Analysis Method**

IBM SPSS 23.0 was used to apply weights. The complex samples plan file was generated before analysis, and the significance level was set at .05.

The characteristics and factors of employed and unemployed married women were analyzed using weighted percentages, and the groups were compared
using the chi-squared test.

The factors contributing to the quality of life of employed or unemployed married women were used in linear regression analyses.

**Results and Discussion**

**Results**

**Comparison of the Subjects’ General Characteristics:** As presented in Table 1, the two groups of employed and unemployed married women showed a significant difference in age ($x^2 = 35.72$, $p < .001$), education level ($x^2 = 19.96$, $p = .003$), number of household members ($x^2 = 12.42$, $p = .004$), frequency of lunch per week ($x^2 = 11.98$, $p = .003$), frequency of dinner per week ($x^2 = 4.83$, $p = .027$), frequency of eating out per week ($x^2 = 317.34$, $p < .001$), and quality of life ($t = 4.48$, $p < .001$). The employed group was older in age and had a higher education level. The unemployed group had a higher number of household members. The employed group had a higher frequency of lunch per week, whereas the unemployed group had a higher frequency of dinner per week. The employed group had a higher frequency of eating out per week and a higher quality of life. Both groups showed no difference in other factors.

**Table 1: Comparison of the subjects’ general characteristics**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Employment (n=976)</th>
<th>Unemployment (n=747)</th>
<th>$x^2$ (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(yr)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td>242(22.3)</td>
<td>286(35.7)</td>
<td>37.93(&lt;.001)</td>
</tr>
<tr>
<td>40-49</td>
<td>349(35.4)</td>
<td>230(31.7)</td>
<td></td>
</tr>
<tr>
<td>50-59</td>
<td>385(39.3)</td>
<td>231(32.5)</td>
<td></td>
</tr>
<tr>
<td>Economic status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>57(6.1)</td>
<td>70(9.2)</td>
<td>9.87(0.666)</td>
</tr>
<tr>
<td>Middle-lower</td>
<td>215(21.6)</td>
<td>186(24.4)</td>
<td></td>
</tr>
<tr>
<td>Middle-upper</td>
<td>332(34.3)</td>
<td>239(32.8)</td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>372(37.4)</td>
<td>250(33.5)</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤Elementary school</td>
<td>90(8.5)</td>
<td>45(6.3)</td>
<td>19.96(0.003)</td>
</tr>
<tr>
<td>Middle school</td>
<td>104(11.3)</td>
<td>50(7.1)</td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>385(42.9)</td>
<td>287(40.2)</td>
<td></td>
</tr>
<tr>
<td>≥College</td>
<td>396(40.7)</td>
<td>364(46.4)</td>
<td></td>
</tr>
<tr>
<td>Number of household members</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>464(47.5)</td>
<td>24(2.8)</td>
<td>12.42(0.004)</td>
</tr>
<tr>
<td>2-3</td>
<td>505(52.7)</td>
<td>544(46.9)</td>
<td></td>
</tr>
<tr>
<td>≥4</td>
<td>425(43.1)</td>
<td>379(50.3)</td>
<td></td>
</tr>
<tr>
<td>Weight change over the past one year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No change</td>
<td>571(58.6)</td>
<td>411(55.6)</td>
<td>1.68(0.579)</td>
</tr>
<tr>
<td>Decreased</td>
<td>98(9.9)</td>
<td>72(10.1)</td>
<td></td>
</tr>
<tr>
<td>Increased</td>
<td>304(31.4)</td>
<td>262(34.3)</td>
<td></td>
</tr>
<tr>
<td>Weight control over the past one year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To reduce</td>
<td>484(50.6)</td>
<td>390(52.2)</td>
<td>2.47(0.614)</td>
</tr>
<tr>
<td>For maintenance</td>
<td>194(20.4)</td>
<td>153(21.2)</td>
<td></td>
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<td>To increase</td>
<td>23(2.7)</td>
<td>24(3.3)</td>
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<tr>
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<td>7-8</td>
<td>444(45.7)</td>
<td>326(42.3)</td>
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<td>267(27.9)</td>
<td>201(26.0)</td>
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<td>632(94.2)</td>
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<td>Frequency of dinner/ week</td>
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<td>≤3/month</td>
<td>162(18.8)</td>
<td>202(30.5)</td>
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Comparison of the Subjects’ Physical and Psychological Factors: As shown in Table 2, among physical factors, both groups showed a significant difference in frequency of undergoing medical check-up ($x^2 = 35.72, p < .001$), number of hours spent sitting ($x^2 = 15.53, p = .006$), number of walking exercise days per week ($x^2 = 7.39, p = .009$), and number of strength exercise days per week ($x^2 = 5.28, p = .034$). The employed group underwent more medical check-ups, whereas the unemployed group spent more hours sitting. The unemployed group did more walking and strength exercises per week. There was no difference between both groups in other factors.

Among psychological factors, both groups showed a difference in depression ($x^2 = 20.96, p < .001$), subjective body image ($x^2 = 13.08, p = .013$), and subjective health status ($x^2 = 13.15, p = .012$). Depression was found more in the unemployed group. In terms of subjective body image, the unemployed group perceived themselves as more overweight. In terms of subjective health, the employed group perceived themselves as healthier. No difference was found between both groups in other factors.

Table 2: Comparison of the subjects’ physical & psychological factors

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<th>Characteristics</th>
<th>Employment (n=976)</th>
<th>Unemployment (n=747)</th>
<th>x^2(p)</th>
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<td>106(10.7)</td>
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<td>870(89.3)</td>
<td>669(89.2)</td>
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<td>Yes</td>
<td>41(4.0)</td>
<td>33(5.6)</td>
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<tr>
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<td>No</td>
<td>935(96.0)</td>
<td>714(94.4)</td>
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<td>718(74.2)</td>
<td>446(60.9)</td>
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<tr>
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<td>No</td>
<td>258(25.8)</td>
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<td>880(91.1)</td>
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<td>105(10.7)</td>
<td>97(14.0)</td>
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<tr>
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<td>221(29.2)</td>
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<td>661(88.2)</td>
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<td>86(11.8)</td>
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<tr>
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<td>34(4.0)</td>
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<td>No</td>
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<td>274(26.8)</td>
<td>212(29.1)</td>
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<tr>
<td></td>
<td>A little feeling</td>
<td>699(73.2)</td>
<td>533(70.9)</td>
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<tr>
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<td>381(52.7)</td>
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<tr>
<td></td>
<td>overweight</td>
<td>142(14.3)</td>
<td>156(20.9)</td>
</tr>
<tr>
<td>Subjective health</td>
<td>Good</td>
<td>290(29.6)</td>
<td>209(26.4)</td>
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<td>544(56.2)</td>
<td>382(52.8)</td>
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<tr>
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<td>Bad</td>
<td>142(14.3)</td>
<td>156(20.9)</td>
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Factors Contributing to the Quality of Life of Subjects: As given in Table 3, the factors contributing to employed married women’s quality of life were education level, number of household members, sleeping hours, depression, and subjective health; their explanatory power was 33.7% (F = 4.45, p < .001).

Quality of life was found to be higher among those who graduated only high school than those with undergraduate degrees or higher, and lower among those with four or more household members than those with two to three household members. Quality of life was found lower among those with six or less sleeping hours than those with nine hours or more. The non-depression group showed a higher quality of life compared with the depression group. For subjective health, those who perceived themselves as healthier showed a higher quality of life.

As for unemployed married women’s quality of life, the contributing factors were economic status, education level, weight change over the past one year, frequency of breakfast per week, subjective body image, subjective health, and depression; their explanatory power was 46.6% (F = 5.85, p < .001).

Regarding economic status, those with a lower economic status had a lower quality of life compared with their upper-class counterparts. For education level, high school graduates showed a higher quality of life than college graduates. The group without any weight change over the past one year had a higher quality of life than the group with increased weight. The group who perceived their subjective body image as normal had a lower quality of life compared with the group who perceived theirs as overweight. As regards subjective health, those who perceived themselves as healthier showed a higher quality of life. The non-depression group showed a higher quality of life than the depression group.

Table 3: Factors contributing to the quality of life of subjects

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<th>p</th>
<th>R²</th>
<th>F</th>
<th>p</th>
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Discussion

This descriptive study conducted a secondary analysis on data from the 2016 KNHANES to examine the factors contributing to employed or unemployed married women’s quality of life.

The results showed that employment could make a difference in quality of life factors: First, in both employed and unemployed groups, education level, subjective health, and depression were significant quality of life factors. In both groups, high school graduates, those who subjectively perceived their health as healthier, and those with less depression showed a higher quality of life. For education level, high school graduates showed a higher quality of life, which was consistent with the finding of Kim and Hong that female high school graduates have a higher quality of life than female elementary school graduates. In contrast, female college graduates have been shown to report a higher quality of life as such, further study needs to be conducted on education level and quality of life. In their study on subjective health and quality of life, Kim and Hong examined middle-aged and elderly full-time housewives and employed housewives; they reported that in both groups, subjective health and satisfaction with their husband and children are significant quality of life factors. In other words, as better subjective health leads to a higher quality of life, subjective health should be the first to be improved through health care to improve married women’s quality of life. The present study also found depression to be a significant quality of life factor in both employed and unemployed married women, consistent with that of a previous study. Therefore, married women need to be examined for depression to improve their quality of life.

Second, although economic status was a quality of life factor among unemployed married women, it was not the case among employed married women. Economic status has been reported as an important quality of life factor for married women. In his study on Korean married women’s quality of life, showed a significant negative correlation between married women’s quality of life and their economic status, disappointment with their husband, and frustration with their children. An and Kim reported in their study on Korean and Chinese employed married women that economic status commonly affects quality of life. More specifically, economic status has an important effect on quality of life as unemployed married women have no choice but to rely on their husband financially and cannot have financial independence compared with their employed counterparts.

Third, the number of household members and sleeping hours were quality of life factors for employed married women, but they not for unemployed married women. More specifically, quality of life was lower in those with four or more household members and nine or more sleeping hours compared with those living with two to three members and six or less sleeping hours. It seems that quality of life was higher because employed married women were more likely to have someone who provided emotional support and shared in household chores when they had more family members, such as parents or siblings than when they lived only with their husband and children. Further, as the group with enough sleep showed a higher quality of life, a measure needs to be developed to enhance the quality of life for employed married women with two to three family members and six or less sleeping hours. For instance, efforts and measures should be implemented at the workplace, local community, and national levels to improve the quality of life of newlywed women who gave birth to their child within the past year.

Fourth, weight change, subjective body image, and breakfast frequency were quality of life factors for unemployed married women, but not for employed married women. In other words, among unemployed married women, those who had no weight change and perceived their subjective body image as overweight showed a higher quality of life than those who had increased weight over the past year and perceived their body as not overweight. This outcome may be attributed to the fact that unemployed married women spend more time at home and react more sensitively to their weight change and subjective body image compared with employed married women.

Conclusion

This study used 2016 KNHANES data and examined 2,893 married women to identify their quality of life depending on their status of employment or unemployment. The analysis revealed that employment made a difference in married women’s quality of life. In both employed and unemployed groups, education level, subjective health, and depression were quality of life factors; the number of household members
and sleeping hours were quality of life factors among employed married women, whereas economic status, weight change, subjective body image, and breakfast were quality of life factors among unemployed married women. Accordingly, the differences between employed and unemployed married women identified in this study need to be considered when establishing intervention or management plans that seek to improve married women’s quality of life.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** - Nil

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Probabilistic Model for Optimal Cell Selection for Seamless Handover in LTE/LTE-A Networks

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Abstract

Increasing communication demand require high data traffic and better quality of service of real-time applications in wireless networks such as video streaming, voice and data communication. In order to meet the desired communication demands, LTE/LTE-A radio access networking technique have been developed which can support high speed UEs. In this field of wireless communication, handover plays important role for high dynamic UEs. Several techniques have been presented to improve handover performance for LTE/LTE-A network. However, conventional techniques suffer from various issues such as pin-pong effect which may degrade the communication quality due to frequent handovers which is caused due to inappropriate or optimal cell selection. In this work, we focus on handover management and developed a novel approach where optimal cell selection process is implemented and later we derive a probabilistic model handover decision making. An extensive experimental study is carried out using MATLAB simulation tool where proposed approach is implemented and compared with the conventional techniques of handover management. Comparative study shows that the proposed approach achieves better performance in terms of packet drop, packet delay and system throughput.

Keywords—LTE/LTE-A, QOS, 3GPP, Handover, Mobility, Seamless.

INTRODUCTION

Recent advancements in the communication technologies has lead towards the tremendous growth of wireless communication technologies in daily life scenario. This increased utilization of wireless communication technologies has proliferated the real-time high mobility and data intensive application based communication systems. In this field, mobile wireless communication technology has gained huge attraction by academia, industry, real-time application and research community due to its significant nature to provide ubiquitous information access while user is moving at high-speed [1]. These networks contain two main components which are responsible for communication as: base station (BS) where network antennas are placed and mobile station (MS) where mobile users are considered with varied mobility speed. In this field of wireless communication technology, WiMAX and LTE are recently introduced and considered as promising techniques which helps to facilitate the mobility support to the mobile stations to guarantee the desired Quality of Services (QoS) [2].

In this field of mobile wireless communication, mobile users move with varied speed hence a proper connectivity, sufficient bandwidth and higher data rate is required for better communication during the communication, network coverage, capacity and data rates need to be considered as important factor which can be very helpful to improve the communication performance by providing ubiquitous multimedia services with low latency. Several techniques have been discussed for improving the QoS in mobile wireless communication which are mainly focused on the improving the spectral efficiency enhancement techniques for next generation wireless communication [3]. In order to meet the desired performance of QoS, Radio Access Network (RAN) based technologies such as LTE (Long-Term Evolution) and LTE-Advanced are introduced by Third-Generation Partnership Program (3GPP). The LTE communication standard based technologies can support the high-speed data communication, support the broadband services and improve the QoS for mobile communication along with the mobile internet applications [4-5]. In these type of mobile wireless communication, seamless mobility and low latency based communication is required during the mobile node’s movement. Currently, several issues are present in such type of mobile communications which need to be addressed such as seamless handover, mobility management and resource allocation to improve the overall performance of the system. In this field of QoS improvement of wireless cellular or mobile communication, handover is considered as an important phase which can significantly enhance the network performance. Handover is a process which allows the user to transfer an ongoing call or data session from channel to another channel connected to the core network. Hence, better QoS, mobility management, and system reliability are based on the seamless handover. Moreover, LTE networks are able to communicate when UE is moving up to the speed of 500 km/h which may
lead towards the degraded efficiency of the network. In this context of handover mechanism, this process becomes more difficult when the user starts moving away from the current serving cell to the target cell. Hence, this process of handover should occur seamlessly fast and frequent without any data loss. The complete process can be obtained by applying seamless mobility handover management which can improve the QoS of the ongoing network application by reducing communication delay and packet loss [6].

On the other hand, LTE and LTE – A networks support the different type of deployment configurations cells such as macro, micro, Pico or femtocell which are based on the coverage space. Macro cell deployment is considered for large communication coverage area which is used for outdoor UEs, Pico and femtocell coverage is considered for small coverage area. Hence, handover process should support switching between different type of network cells along with different type of radio access networks such as Wi-Fi, General Packet Radio Service (GPRS), World-wide Interoperability for Microwave Access (WiMAX), and Universal Mobile Telecommunications Service (UMTS), etc. Generally, handover in LTE/LTE-A can be classified into two main categories as: horizontal handover where same type of network cells are used for handover operation, vertical handover where different type of network cells are used for handover. Figure 1 shows homogenous and heterogeneous handover process in mobile wireless cellular communication systems.

A. Issues and Challenges in Handover Process

Several techniques have been presented for handover and mobility management in this field of wireless mobile communication. However, handover mechanism may suffer from various issues such as accurate location identification of base station which affects the communication link establishment between base station and UE. Moreover, computational complexity of these systems also arise a challenging issue to identify the appropriate base station for link establishment from the identified list. At this stage, if the identified locations are not accurate then mobile stations keeps ping-ponging to identify the accurate position for better connection. This ping-pong effect may cause unnecessary handoff process, degraded network throughput, handoff delay and packet drop probability. Another issue may be caused due to the inter-cell and co-channel interference due to the neighbouring base stations which degrades the received signal strength. Moreover, high mobility may cause frequent variations in the handover which will cause packet drop, delay and overall throughput of the network.

B. Work Contribution

As discussed in previous sub-section, several approaches have been presented for handover mechanism in wireless mobile networks but due to increased data traffic and high mobility several issues are raised in the handover management process. hence there is a need to develop an efficient approach for handover management for seamless mobility in wireless communication networks. In order to deal with this issue, we present a
novel approach for seamless mobility management in wireless communication networks. The main contribution of the proposed approach are as follows:

(a) Development of horizontal handover for dynamic UEs.
(b) Implementation of optimal neighbouring cell selection process.
(c) Development of probability based model for handover decision.

C. Organization

Rest of the article is organized as follows: section II presents a brief discussion about recent studies, their work contribution and advantages in the seamless mobility management. section III focuses on the development of proposed approach for handover management for LTE/LTE-A networks. Section IV presents discussion about the obtained performance using proposed approach and comparison with the existing techniques of handover management in LTE/LTE-A networks. Finally, section V presents concluding remarks and future work.

RELATED WORK

In this section we present some recent trends and techniques which are introduced for efficient seamless handover and mobility management in the wireless communication networks. As discussed in previous section, handover process is mainly categorized into two main categories as vertical and horizontal handover. In this work, we have considered LTE/LTE-A based scheme which have different type of communication cell configuration. We present a brief discussion about both vertical and horizontal handover mechanisms. Sadik et al. [8] focused on the LTE networks and developed handover process in multi-tier LTE networks with Femto cell configuration. Authors considered heterogeneous network (HetNet) and discussed about the multi-attribute decision making approaches for QoS improvement by reducing the number of handover blocking probability of mobile user. Several studies have concluded that handover delay and network discovery is still considered as a challenging task. Moreover, interference also can limit the performance of communication during handover process. In order to overcome this issue, SDN (Software Defined Networking) approach has been developed to assist the handover which operates in a centralized controller manner. in this work, authors presented a new approach for improving the QoS, delay reduction and interference cancellation using Fuzzy logic in SDN. Handover decision is made based on the TOPSIS and AHP algorithms. Later, frequency reuse and power control scheme is applied to improve the network capacity and reduce the interference. Similarly, Kalpana et al. [9] presented handover mechanism for heterogeneous wireless networks and introduced a new approach for vertical handover to support the seamless and ubiquitous connections. Along with the selection of optimal access point for handover decision making, authentication protocols are also incorporated during the execution of vertical handover. This study presents a combined approach for handover and security for wireless networks. In LTE networks, mobile users can move at higher speed and the accurate location of mobile and base stations cannot be identified hence frequent handover occurs. Due to frequent variations, appropriate cell cannot be identified which results in ping-ponging effect during the handover process. Tsai et al. [12] focused on handover process in wireless networks and introduced an intelligent approach using Fuzzy-logic systems for handover decision management to mitigate the Ping-Pong Effect in LTE systems by developing Ping-Pong Handover System. According to this process, five parameters are considered mainly which are known as signal to noise ratio, detected SNR, bandwidth utilization of eNB, bandwidth utilization of target eNB and residual energy of the UE. These parameters are considered as input parameters and fuzzy rules are formed for handover management in wireless cellular networks.

In another work, Hussein et al. [13] studied about the issue of appropriate cell selection during handover. Accurate cell selection improves the performance significantly hence authors focused on seamless handover for LTE networks. During communication, if successful handover is performed but if the cell location is not appropriate then also it may affect the system performance hence optimal cell identification is an important task which is responsible for the quality improvement using handover. In order to address this issue, authors presented fuzzy logic approach with the help of TOPSIS on S-criterion, resource block and signal-to-interference-plus-noise ratio. However, several approaches have been presented which are generally based on the S-criterion which are highly dependent on the downlink signal quality. This issue is addressed using fuzzy multiple-criteria cell selection (FMCCS) which considers resource block utilization based on S-criterion. Recently, Castro-Hernandez et al. [14] presented a new optimization strategy for handover optimization for different loading scenarios. This work uses a learning process which learns the data pattern based on the received signal strength and applies handover optimization parameters. Moreover, this approach considers handover management and cell-edge load levels. This approach provides security assisted handover management scheme. Bellido et al. [15] introduced handover management scheme in LTE networks for video broadcasting and unicast streaming. This approach is mainly based on the vertical handover process where the handover is performed between different technologies without dropping the data communication during the video data transmission. This approach considers different channel conditions and adapts them according to the required streaming process.
PROPOSED MODEL

Previous section discussed about the recent techniques in this field of handover management in LTE/LTE-A based wireless networks. However, several schemes have been introduced to improve the handover task for improving the overall performance of communication. The conventional techniques suffer from various issues such as ping-pong effect, inappropriate cell selection and high mobility. In this section we discuss about the proposed approach for seamless handover and mobility management in wireless networks.

A. General Process of Handover

In this section we present a brief discussion about general process of handover in LTE networks. The complete handover process is depicted in figure 3.

Main stages of this process are described as follows:

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The UE sends a measurement report (MR) to the serving node</td>
</tr>
<tr>
<td>2.</td>
<td>Serving node considers the measurement report parameters and radio resource parameters for handover decision making.</td>
</tr>
<tr>
<td>3.</td>
<td>Currently serving node sends a handover request to the target node eNB which carries handover information.</td>
</tr>
<tr>
<td>4.</td>
<td>Target node uses Admission control process to make the decision for granting the handover request based on the available information and resources.</td>
</tr>
<tr>
<td>5.</td>
<td>Serving node receives an “Ack” message regarding the handover request and serving node transmits a handover command with the mobility control and informs that the current UE is going to handover to the neighboring eNB.</td>
</tr>
<tr>
<td>6.</td>
<td>Once the handover command is received, the UE disconnect from the current eNB and establishes the connection between new eNB and UE.</td>
</tr>
<tr>
<td>7.</td>
<td>In next phase, UE transmits the Radio Resource Control (RRC) Connection Reconfiguration Complete Message which is used for identifying the handover information.</td>
</tr>
</tbody>
</table>

B. Improving the handover in LTE

As discussed before, received signal strength is affected due to the movement of UE which are continuously moving in the defined LTE network area. Communication quality can be degraded if the poor-quality base station and UE are communicating to each other. Hence, identifying the neighboring cell promptly can improve the communication quality by transferring the communication phase to the identified neighboring cell. In this work we present a novel approach to identify the best suitable neighboring node for handover decision making. In order to perform this task, UEs maintain a list of eNB candidates based on their current positions which can be used for further analysis. For each eNB weights are computed and the best weight cell is selected for initializing the handover operation. Proposed approach uses RSRP measurement between serving and target nodes to identify the neighboring eNB. Let us consider that positions of UEs are given as $P_{t-2}, P_{t-1}$ and $P_t$ where $P_t$ denotes the current position and $P_{t-2}$ and $P_{t-1}$ are the positions at different time units. In this process, the position data is updated in the form of angle based on their movement which can be computed as:
\[ \alpha = \arg \cos \left( \frac{\mathcal{P}_{t-2} \times \mathcal{P}_{t-2-1}}{|\mathcal{P}_{t-2-1}| \times |\mathcal{P}_{t-2}|} \right) \] (1)

\[ \text{Candidate eNB} \begin{cases} \alpha \leq \gamma \\ \mathcal{L}_{\mathcal{P}_{t-1}} \mathcal{P}_{t-2} \mathcal{P}_{\text{eNB}} \leq \alpha \\ \mathcal{L}_{\mathcal{P}_{t-2}} \mathcal{P}_{t-2} \mathcal{P}_{\text{eNB}} \leq \alpha \\ \text{Dist} \leq 2D \end{cases} \] (2)

Where \( \mathcal{P}_{\text{eNB}} \) denotes the position of eNB and \( D \) is used for inter site distance measurement. Based on these assumptions, we apply the handover decision making approach. Figure 4 shows the significance of various parameters used in the handover process which are as follows: \( \text{Diff}_{\text{RSS}} \), \( \text{Diff}_{\text{DH}} \), \( R \) \( \text{HOM} \) and \( \text{TST} \). These parameters can be computed as follows:

\[ \text{Diff}_{\text{RSS}} \text{ is the measurement of difference of RSRP of the current UE between target node (T) and serving node (S) at time t, this can be expressed as:} \]

\[ \text{Diff}_{\text{RSS}}(t) = \text{RSRP}_T(t) - \text{RSRP}_S(t) \] (3)

\[ \text{Difference between Diff}_{\text{RSS}} \text{ and handover margin is denoted by Diff}_{\text{DH}}, \text{ this gives the measurement of the last time when UEs are getting services from the current eNB, this can be computed as:} \]

\[ \text{Diff}_{\text{DH}}(t) = \text{Diff}_{\text{RSS}}(t) - \text{HOM} \] (4)

Finally, we compute the rate of difference which can be estimated by taking the differences between two RSRP and this growth rate can be computed as follows:

\[ R(t) = \frac{\text{Diff}_{\text{DH}}(t) - \text{Diff}_{\text{DH}}(t-1)}{\text{Diff}_{\text{DH}}(t-1)} \]

\[ = \frac{\text{Diff}_{\text{RSS}}(t) - \text{Diff}_{\text{RSS}}(t-1)}{\text{Diff}_{\text{RSS}}(t-1) - \text{HOM}} \] (5)

In this process, there are two phases of handover can be presented which are called as: early handover triggering phase and late handover triggering. Early triggering occurs when handover margin is less than the \( \text{TST} \) and late triggering occurs when it crosses the limit of \( \text{TST} \).

In order to make it more robust, we present a probability model for handover decision making where we assume that the power consumption of each eNB is equal along with shadow and Doppler effects. The received signal power from node eNB\( i \) can be expressed as:

\[ \mathbb{P}_i = \mathbb{P} \cdot 10^{-\frac{\text{PL}(d_i)}{10} + \frac{\mu_i + \phi_i}{10}} i = 1,2,3..N \] (6)

The above-given power consumption is represented where it is assumed that eNB1 is serving to eNB2. \( d_i \) denotes the distance between UE and eNB\( i \). \( \text{PL}(d_i) \) denotes the path loss measurement for the distance between UE and eNB, \( \mu_i \) denotes the shadow fading with zero-mean distribution, \( \phi_i \) denotes the Doppler effect. As discussed before, when the signal strength is less than the neighbouring cell threshold \( \gamma \), then UE sends corresponding measurement reports to the eNB and handover decision is made. Here, we compute path gain as:

\[ \mathbb{G}_i = 10^{-\frac{\text{PL}(d_i)}{10}}, 10^{-\frac{\mu_i + \phi_i}{10}} i = 1,2,3..N \] (7)

With the help of this, the handover probability can be given as:

\[ \mathcal{P}_{\text{HNO}} = \Pr[10 \log \mathbb{G}_2 - 10 \log \mathbb{G}_1 \geq \gamma] \] (8)

Let us consider that \( \mu_2 = \mu_0 \) hence the expression can be re-written as:

\[ \mathcal{P}_{\text{HNO}} = \int_{-\infty}^{\mu_0} \Pr[10 \log \mathbb{G}_2 - 10 \log \mathbb{G}_1 \geq \gamma] \mu_2 = \mu_0, \Pr[\mu_2 = \mu_0] = \mu_0 \] (9)

This probability function is used for making the handover decision. If the probability value is higher than handover is triggered and executed and very less, then it no handover decision is performed.

**EXPERIMENTAL STUDY**

In this section we present complete discussion about the obtained performance using proposed approach for horizontal seamless handover in LTE/LTE-A networks. The complete experimental study is implemented using MATLAB simulation tool running on windows platform with the i3 intel processor. The performance of proposed computed in terms of average number of handovers, packet loss ratio, packet delay ratio and throughput for varied number of UEs and speed for uplink and
downlink communications. The complete simulation parameters are given in table 1.

<table>
<thead>
<tr>
<th>Simulation Parameter</th>
<th>Considered value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency</td>
<td>2GHz</td>
</tr>
<tr>
<td>System Bandwidth</td>
<td>5 MHz</td>
</tr>
<tr>
<td>Tx power of each cell</td>
<td>43 dBm</td>
</tr>
<tr>
<td>Total number of cells</td>
<td>7</td>
</tr>
<tr>
<td>Radius of cell</td>
<td>1 km</td>
</tr>
<tr>
<td>Path loss</td>
<td>$128.1 + 37.6 \log_{10}(R)$</td>
</tr>
<tr>
<td>UEs</td>
<td>42,84 and 126</td>
</tr>
<tr>
<td>UE speed</td>
<td>30,120,150 km/h</td>
</tr>
<tr>
<td>Mobility model</td>
<td>Regular and random</td>
</tr>
<tr>
<td>Data traffic type</td>
<td>Constant bit rate (CBR)</td>
</tr>
<tr>
<td>RSRP threshold</td>
<td>-80dBm</td>
</tr>
</tbody>
</table>

In this work, we have considered hexagonal cell scenario where total 7 number of cells are deployed with the 1 KM radius and each eNB contains three sectors with no overlapping between communicating channels. Figure 5 shows a sample network topology with 7 cell scenario.

**Figure 5 seven cell scenario**

The above given network scenario contains total seven number of cells where each cell is of 1 KM radius and each cell is not having any overlapping channels. In this scenario, UEs are distributed regularly into seven cells. This communication system uses a carrier frequency of 2GHz and bandwidth of 5MHz.

### A. Performance Measurement

In this section we briefly describe the performance measurement parameters which are defined as follows:

(a) **Average number of handovers**: this is the measurement of average handovers occurred during the complete simulation process. The frequent handover degrades the performance due to delay and packet drop. The average handover can be computed as:

$$\text{Avg Handover} = \frac{\text{Total Number of Handover}}{\text{Simulation Time}} \quad (1)$$

(b) **Packet loss ratio**: this is the measurement of total number of lost packets during the complete simulation phase and computed by taking the difference of total number of packets and received packets over a given simulation time. This can be expressed as:

$$\text{PLR} = \frac{\text{Packet}_s - \text{Packet}_r}{\text{Simulation Time}} \quad (2)$$

Where $\text{Packet}_s$ denotes the ideal number of packets to be generated in the given simulation time and $\text{Packet}_r$ denotes the total number of received packets.

(c) **Packet delay ratio**: this is the measurement of total overall delay when eNB is serving UEs’s $i^{th}$ packet while total $E$ number of packets are received during the given simulation time. This can be computed as:

$$\text{Packet delay ratio} = \frac{\sum_k \sum_i d_{ki}}{E} \quad (3)$$

Where $d_{ki}$ denotes the total packet delay of the current UE at eNB$_k$.

(d) **Throughput**: this is computed by taking the ratio of total correctly received packets at the receiver end. This can be given as:

$$\text{Throughput} = \frac{\sum_k \sum_i N_{ki}}{\text{Simulation Time}} \quad (4)$$

### B. Comparative analysis

In this subsection, a comparative study is presented which shows a robust performance improvement in the LTE/LTE-A networks. The proposed approach is compared with the existing state-of-art techniques such as MDIH-HD [10], Wang et. al. [11], 3GPP standards. The complete experimental study is divided into two scenarios as: varied speed of UEs and varied number of UEs. The performance is measured in terms of average number of handovers, packet delay rate, packet drop ratio and system throughput.

**Performance measurement of varied speed of UEs**

In this subsection we evaluate the performance by varying the speed of UEs and compared with the exiting techniques figure 6 shows a comparative analysis in terms of average number of handover for varied speed of UEs.

![Average Number of Handover Vs Varied Speed of UEs](image_url)

According to the experimental study as the speed of UE is increased the average number of handover also increased. However, the proposed approach shows a better performance by achieving less number of...
handovers. This shows that proposed approach provides better connectivity and stability when compared with the existing approaches. In next experiment, we have computed the packet delay rate performance and compared with the existing technique. This experiment also uses similar configuration as previous experiment.

Previous experiment shows better connectivity when speed of UE is varied. This connectivity helps to improve the communication based on this assumption, we compute the packet delay rate performance of proposed approach and compared with the existing techniques. Figure 7 shows this experimental analysis which shows that proposed approach achieves less packet delay when compared with the other techniques. As speed of UE is increased packet delay rate also increases due to unnecessary handovers.

With the help of similar experimental setup as used in previous two experiments, we compute the packet drop rate performance for varied speed of UEs and compared with the existing techniques as mentioned before. Figure 8 shows a comparative performance in terms of packet drop rate for varied speed of UEs. However, less speed achieves lower packet drop but high-mobility scenario works on the higher speed hence proposed approach shows promising performance for high speed consideration. Finally, we compute the system throughput for the similar experimental configuration and obtained performance is compared with the existing techniques of handover management in LTE/LTE-A in figure 9.

Performance measurement of varied number of UEs

In this subsection, we present experimental analysis for varied number of UEs however, other simulation configuration parameters are similar to the previous experiments. First of all, we compute the performance in terms of average number of handovers for varied number of UEs.

Figure 10 shows experimental study where number of UEs are varied as 42, 84 and 126 and the average handovers are computed. It can be concluded that more number of UEs will result in more numbers of handovers in the given simulation period. Comparative study shows that proposed approach is able to achieve less number of handover when compared with the other techniques. In next phase, we compute the packet delay rate for varied number of UEs this comparative performance is depicted in figure 11.

Figure 11 shows that the proposed approach achieves better performance in terms of packet drop delay rate for
varied number of UEs. As number of UEs increasing, the packet delay rate also increases but proposed approach is able to handle the handover jitters and maintains the packet delay rate. Similarly, we have computed packet drop rate performance as given in figure 12.

![Figure 12 Packet drop rate performance](image)

Finally, we compute the system throughput performance for varied number of UEs. This performance measurement is depicted in figure 13.

![Figure 13 Throughput performance](image)

Figure 13 shows a comparative performance of system throughput for varied number of users. The proposed approach achieves better performance in terms of overall stem throughput when compared with the existing techniques. With the help of this experiment, it can be shown that the proposed approach achieves better performance for LTE/LTE-A networks.

**CONCLUSION**

In this work, we focus on the wireless communication system performance enhancement strategy. Currently growing techniques demand for high speed data ubiquitous data along with the high speed mobile devices during communication. This issue can be addressed using LTE/LTE-A based scheme but these techniques suffer from the communication breaking scenarios due to high mobility in the UEs. This issue can be addressed using seamless handover approach. In this work we present a handover mechanism for LTE networks. According to proposed approach, first of all we present a novel approach for optimal cell selection which reduces frequent handover and ping-pong effect resulting network stability and reliability. Later, we developed handover decision making process for handover command execution. Proposed approach is compared with the existing techniques and comparative study shows that proposed approach can achieve better performance.

**Ethical clearance** - Not required

**Source of funding** - Self

**Conflict of Interest** - Nil

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A Comparative Performance Evaluation Approach to Assess Data Security using Cryptographic Algorithms

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Abstract

Data security is of utmost importance these days due to widespread usage of cloud environment for storage of data. As the data is stored in chunks in multiple location servers, it is quite difficult to manage the access control and privacy. Being significant to any stream, data security has gained immense popularity in research. Cryptography plays a vital role in preserving data confidentiality from unauthorized access and intruders. Though this area is researched a lot but new cryptographic schemes are introduced frequently to upgrade the level of security. In this paper we review some of the most popular cryptographic mechanisms used in data storage environment, especially in cloud to protect privacy and integrity of data. We finally compare efficiency of algorithms with respect to operational time consumption. Simulation results demonstrates the comparative performance of symmetric, asymmetric algorithms and hashing mechanisms among the peers.

Keywords—Data Security, Cloud Computing, Cryptography, Access Control, ABE.

Introduction

Today, accessibility of information has become pretty easier through internet. The distance in miles have become seconds because of internet technology and cloud services. For example, any sort of data can be transferred to different places in seconds with the help of electronic mail. Centralization of data has also helped corporates and companies to streamline their business and operate globally without worrying about accessibility of remote data. Cloud environment has enabled its users to connect seamlessly around the globe. Storage capacity of personal devices do not bother users anymore due to easy connectivity of devices with huge cloud storage. Digital revolution has enabled users to roam freely anywhere in the world without carrying physical documents and allowed secured access. But the same time it has opened floodgates to security and privacy issues.

In late 2013, there happened an extensive data privacy breach in the 3 major conglomerates of united states namely Target, Michaels and Neiman Marcus. Hackers have magnificently stolen 40 million debit and credit card information and 70 million personal identity information from Target, credit and debit card information of 3 million customers from Michaels and 1.1 million customers from Neiman Marcus [¹]. eBay too in mid 2014s declared publicly that since the beginning of 2014 hackers have illegally accessed 145 million customers’ user IDs, contact numbers, email IDs, postal addresses and birth date [²]. In late 2014s, K-Mart (a retail giant) declared that in September same year, due to a network security breach, hackers have potentially retrieved information about their customers debit and credit card [³]. In recent times, the instances of wannacry and petya have created panic among the service providers [⁴]. Hence, keeping data confidential is the responsibility of the service providers to keep trust of its customers and avoid data breach.

The IoT boom recently has led to huge aggregation and storage of data on cloud. With the devastating rate of growth, it is predicted that we would have 50+ billion connected devices [⁵][⁶] generating 44 Zettabytes of data by 2020 [⁷]. There would be vital need to safeguard the vulnerable data flowing through various channels in diverse networks. This is where Data Security comes into picture. Data Security can be defined as the science
and study of methods of protecting data in computer and communication from unauthorized disclosure and modification. Thus, it is crucial to do a comprehensive research on different types of cryptographic and security techniques to assess their potential in safeguarding the information and their efficiency. In this paper we focus on various popular cryptographic algorithms, their modus operandi and evaluate their efficiency. All the simulations will be carried out using JCE and BouncyCastle API.

The organization of this paper is as follows. Section 2 of this paper contains recent studies in cryptography field. Literature review on various works comprising cryptographic algorithms is performed here. Section 3 presents fundamentals of cryptography and its classification. Section 4 presents detailed explanation of some of the most popular cryptographic algorithms. Section 5 briefs hybrid cryptography and its working. Section 6 presents experimental outcomes for various test cases on each algorithm. Finally, section 7 concludes the work and presents the summary with future directions.

Related Work

Kajal Chachapara et al. [8] defines the cloud model and discusses the popularity that cloud computing is gaining these days. They proposed a scheme where it is mandatory for cloud service providers to issue separate keys for the individuals since the security of data in public cloud is more significant. They proposed the use of cryptography algorithms such as AES and RSA in order to secure the data on the cloud. In their scheme, though the user will have the key, the permission to access the information will be provided by the owner of the cloud. They have proposed a system to share the data conditionally to different users which is encrypted with AES algorithm. It is analyzed that their scheme creates more security but creates the drawback of “partial access” to the users.

N.Jayapandian et al. [9] states that classification of clouds depends upon the type of access it provides to its users. They broadly classified the encryption techniques as symmetric and asymmetric key encryption. They also discussed two types of symmetric key encryption types i.e. AES and DES algorithm. As per them, issues in cloud computing arises at various levels of data cycle and there is a need to address these issues in a time bound manner. DES and RSA algorithms are discussed in detail along with their encryption and decryption techniques. They compared both of it using various performance parameters such as key length, power consumption, speed, implementation cost etc. Finally, through comparison it is stated that the choice of the algorithm depends on application and it is not generic for all.

Sourabh Chandra et al. [10] defines network security, the need of cryptography in today world and its types. The types of cryptography are also defined in detail. The types of symmetric key algorithms such as DES, 3DES, AES and Blowfish are mentioned along with features and they are compared in performance metrics. Similarly, asymmetric key algorithms such as RSA and DH are discussed briefly with its features and compared in terms of performance. They also demonstrated the advantages and disadvantages of each algorithm. They highlighted the need for further research and concluded by preferred use of symmetric key algorithm due to its simplicity in implementation.

Saranzaya Purevja et al. [11] discussed the height of usage of internet technology in this century and the need of data security for the users’ trust. They suggested the usage of hybrid encryption technique combining RSA and Blowfish algorithm. They also discussed the implementation methods to achieve this type of encryption scheme in applications. In their scheme, they first authenticate the user before giving any access of storing or retrieving the data. The private keys are assigned using RSA algorithm and the files are encrypted using hybrid cryptography. Also, the decryption is done by Blowfish keys. They proved their scheme with the obtained results.

Vikas K.Soman et al. [12] mentioned the importance of confidentiality and integrity of data in the cloud. Types of clouds were also discussed in their research along with the examples. They hinted on the challenges faced in various aspects of data security with the help of statistical data. They utilized one of the variants of SHA i.e. SHA-256 and AES encryption to secure the data in the cloud. They provided the experimental results to support their concepts and also mentioned the need for future work in this field.

Shweta Kaushik et al. [13] highlighted the advantages of using cloud in various aspects of data cycle along with the need of cryptography in this field. They also discussed the goals of a cryptographic system and its types along
with definitions. They illustrated simple encryption and decryption algorithm with an example along with the related works in this field. They concluded their research by highlighting the advantages of encryption techniques brought to the owner of cloud and suggested its compulsory usage by service providers.

Punam V. Maitri et al. [14] illustrated the working of cryptography on data along with its types and variants. They referred the encryption pertaining image as data and used stenography method in the proposed system. They utilized AES and RSA hybrid algorithm for the purpose of cryptographic functions. They stated the advantage of each algorithm individually and highlight the shortcoming that are solved through hybrid cryptography. They also mentioned the disadvantages of common hybrid crypto system and derived a new hybrid system by combining four algorithms namely AES, RC6, Blowfish and Byte Rotation Algorithm. They compared their results with the existing works and concluded that their proposed implementation has achieved outstanding “block wise data security”.

Divya Prathana Timothy et al. [15] appreciated the ease with which the cloud computing provides services. They discussed the advantage of easier data handling and the need for security during the data handling. They suggested hybrid cryptosystem in this regard. The earlier works regarding hybrid cryptosystem along with their area of application are quoted. They proposed a hybrid system that uses Blowfish, RSA and SHA-2 algorithms. In their scheme, encryption is achieved using Blowfish and authentication is done using RSA. The generated blowfish secret key is encrypted using RSA. SHA-2 algorithm is used for signature verification. The proposed results claim to provide highly efficient operations in data security.

Nagesh et al [16] in their paper stated that popular websites and apps outsource huge amount of user data to cloud, which needs better security and access control. They highlighted importance of cloud but the same time pointed on various concerns that exists on data security. Confidentiality issues due to multiple attacks on cloud has still kept many users isolated from using outsourcing services. They state that privacy and integrity are the major components of data security that needs immediate attention. Their research demonstrated that data security is still a concern for many and there is a huge scope of improvements in it.

**Cryptography Fundamentals**

Cryptography is a mechanism wherein the data is converted to encoded text or cipher text which is protected from the intruders while transmission or unauthorized access. Due to it, only intended and legitimate entities can view the raw information by decoding ciphers [8]. Intention of using cryptographic coding technique is to keep the data secure from the intruders. The cryptographic techniques are believed to have been developed along with the origin of language used for communication. For instance, during warfare it was used by soldiers and even by king to transmit important information. “Hieroglyph” is known to be the first ever cryptographic techniques used by Egyptians. Cryptography involves the following process:

a. Encryption: Transforming the data or message into cipher text with the help of secret key

b. Transit: Transmission of the Encrypted information

c. Decryption: Conversion of encrypted data to raw data using decryption key.

Cryptography algorithms are basically classified to 3 types i.e. Asymmetric, Symmetric and Hash function [10].

**Figure 1: Cryptography Classification**

**A. Asymmetric Cryptography**

It is more commonly known as Public key cryptography. Here different keys are used for encryption and decryption. The keys are called as public and private keys. The disclosure of public key is permitted but private key disclosure is not permitted. There are different types in asymmetric cryptography namely RSA (Rivest Shamir and Adleman), DSA (Digital Signature Algorithm, Diffie Hellman, etc.)
B. Symmetric cryptography

In this type, encryption and decryption is done using the same key. The utilization of common key has derived its name as symmetric cryptography. Till 1970’s the only known encryption technique was this. The different types of symmetric cryptography are DES, Triple DES, AES. The main task is to ensure the confidentiality of the data.

C. Hash Function

This is another cryptographic technique where the input message of arbitrary length is converted to fixed length output called “Hash value” using a mathematical function. The input arbitrary length data is compressed into much smaller length data. Hence it is known as compression function. It is one-way encryption, where decryption is not possible.

STANDARD ALGORITHMS

D. RSA (Rivest Shamir and Adleman) Algorithm

It belongs to the class of asymmetric cryptography in which there will be presence of two keys namely public and private keys. The private key is assured to be secure based on the fact that factoring of large numbers is difficult. Hence, more the key size, more difficult to factor it and more is the security. The illustration of the Algorithm is in the figure below:

![Figure 2 RSA Algorithm](image)

Main advantage of RSA algorithm is the complexity to crack the key and access the original data since it involves tedious process of factoring the large prime numbers and mathematical operations. The only disadvantage of RSA is, it slows down the operations if large amount of data is to be encrypted.

E. Diffie-Hellman Algorithm

This is another asymmetric class algorithm that was designed to overcome the disadvantage of hacking of secure keys over the course of transmission. In this algorithm, the two communicating entities will generate the public keys individually and exchange them. The exchanged keys are used to generate private key which is symmetric to both the entities using DH Algorithm. The illustration can be seen in the figure below:

![Figure 3 Diffie-Hellman Algorithm](image)

Diffie-Hellman key exchange is one of the best among its pers for authentication and secures communication from intruders but the same time it overburdens the system initially for the authorization and also it is not applicable for encryption purpose.

F. Data Encryption Standard (DES) Algorithm

The most popular encryption algorithm is DES. This is categorized under symmetric class. As per US National Bureau of Standards, this algorithm was to be utilized only for data that are not classified. Here the key will be of length 56 bits for a block of 64 bits data. This involves 16 rounds of processing before the final cipher text is out.

![Figure 4 DES Algorithm](image)

This algorithm is now being considered as weak standard due to low level of security but due to its simple operations it is time efficient in processing data.

G. Triple DES (3DES) Algorithm

This is another symmetric class algorithm. The key length used in this technique is significantly longer when compared to other algorithms. This was done to ensure more that the data is safe. But the disadvantage is that it is slower when compared to DES. As the name itself
indicates, it uses triple keys each of length 56 bits [10]. The steps involved are, first the input data is encrypted using the first key, next, the output of the first block is decrypted using the second key, next, the output of the second stage is again encrypted using the third key and then finally, the output of the third stage is the ciphertext.

**I. RC2 Algorithm**

It is a symmetric encryption algorithm with no fixed key length (variable). It is of type 64-bit block cipher. There are 2 tasks that are performed during RC2 encryption namely, mixing and mashing. The plain text will undergo with 16 mixing tasks and two mashing tasks. RC2 was mainly designed as an efficient replacement for DES algorithm [19]. The mixing and mashing tasks are interleaved between each other as, 5 times mixing task, next, 1-time mashing, next, 6 times mixing, next, 1-time mashing, finally 5 times mixing round is performed. Therefore, totally 18 rounds of tasks are involved.

**Figure 5 Triple DES Algorithm**

Major advantage of 3-DES is its security due to the usage of longer key length and repeated operations. But the same time due to multiple operations this algorithm exhibits inefficiency in encrypting large messages. It is considered a really slow and outdated algorithm compared to today’s standards.

**H. Advanced Encryption Standard (AES) Algorithm**

It is another symmetric algorithm but unlike DES it involves multiple stages of computing. The number of stages of computing depends on the length of the key [10]. In this algorithm the size of the data is considered in bytes. The security implementation of this algorithm is stronger compared to DES.

**Figure 6 AES algorithm**

AES has various advantages such as it enables the implementation in simulation and also in hardware. Also, it is very difficult to crack the key and get information since there is utilization of large length keys. \(2^{128}\) are the number of trials required for 128 bits key. Drawbacks of AES are very limited but it is said to have simpler algebraic structure and encryption of every block is done in the similar manner.

**J. RC4 Algorithm**

It is a symmetric stream cipher algorithm with variable key length. There is generation of pseudorandom stream by the algorithm which is performed with XOR operation with the incoming data stream to obtain the cipher [19]. The implementation is as shown in the figure below:

**Figure 7 RC2 algorithm**

Main advantage of RC2 is, compared to DES algorithm it has two times faster software implementation. But the encryption and decryption processes are comparatively different that increases the implementation cost.

**Figure 8 Implementation of RC4 Algorithm**

Key generation in RC4 algorithm is quite simple and fast when compared to RC2 but the probability of
key reuse is high and hence key reuse may result in security compromise.

K. Blowfish Algorithm

It is a symmetric cipher with 64-bit block length and no fixed key length. Implementation involves the performance of XOR operation and a function 16 times to generate the cipher text. Easy implementation and quick performance can be expected when implemented on a 32-bit microprocessor \[^{[19]}\]. The implementation is as shown in the figure below:

![Blowfish algorithm encryption](image)

Figure 9 Blowfish algorithm encryption.

Blowfish has a basic advantage that it is easy availability since it is not subjected to any patents. But each group in blowfish have only two users and that group has a unique key. Hence key managing the number of keys becomes a difficult task. Also, authentication is not guaranteed since it provides same key to two people.

L. MD5 OR Message Digest 5

MD5 is a Hash function algorithm which is capable to compress any variable data length into 128 bits which is called as the “Digital Fingerprint” of the original data.

![MD5 Algorithm](image)

It involves series of complex operations which makes it difficult for the intruder to hack the data. The input message is divided into blocks with each block having 512 bits. Further the blocks are divided to form 32-bit message blocks \[^{[20]}\]. The procedure is illustrated in the figure below:

![Figure 10 MD5 Algorithm](image)

Figure 10 MD5 Algorithm

MD5 algorithm’s advantage is its resistance to collision and its less vulnerability to collision characters. But its security is less when compared to SHA series algorithms.

M. SHA-1 (Secure Hash Algorithm)

It is another hash function Algorithm that is applicable to those messages with message length less than 264 bits. The output of the SHA algorithm is called “Message Digest” \[^{[20]}\]. Advantage of SHA-1 is it is comparatively more secure than MD5 and no official complaints of attacks on this algorithm yet. But implementation is slower when compared to MD5.
enhancing the security [21]. The steps involved in data and key sharing can be illustrated as:

**HYBRID CRYPTOGRAPHY**

When a combination of two or more algorithms are used for encryption then it is defined as hybrid cryptography. The hybrid combination involves both symmetric and asymmetric cryptographic techniques. Both the consisting algorithms have their own advantages and disadvantages. This hybrid combination helps in overcoming the disadvantages of individual algorithms and increase the level of protection of the system by

N. SHA-2

It is advanced hash function algorithm and being used very popularly. It has further six variants namely SHA-224, SHA-256, SHA-384, SHA-512, SHA-512/224, SHA 512/256 [20].

O. SHA-3

It was added to Hash Functions in 2015 by NIST. It is a subgroup of another cryptographic group called “KECCAK”. “Sponge Construction” forms the basis of this group. The variants of SHA-3 are SHA-224, SHA-256, SHA-384, SHA-512, SHAKE 128 and SHAKE 256 [20]. The information regarding all these is as shown in the table 1 above.

### Table 1: Comparison of different SHA Variants

<table>
<thead>
<tr>
<th>Algorithm and variant</th>
<th>Output size (bits)</th>
<th>Internal state size (bits)</th>
<th>Block size (bits)</th>
<th>Max message size (bits)</th>
<th>Rounds</th>
<th>Operations</th>
<th>Security bits</th>
<th>Example performance (MiB/s)</th>
<th>First Published</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD5 (as reference)</td>
<td>128</td>
<td>128 (4 x 32)</td>
<td>512</td>
<td>Unltd(^2)</td>
<td>64</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or</td>
<td>&lt;64 collisions found</td>
<td>325</td>
<td>1992</td>
</tr>
<tr>
<td>SHA-0</td>
<td>160</td>
<td>160 (5 x 32)</td>
<td>512</td>
<td>(2^{64} - 1)</td>
<td>80</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or</td>
<td>&lt;80 collisions found</td>
<td>-</td>
<td>1993</td>
</tr>
<tr>
<td>SHA-1</td>
<td>160</td>
<td>160 (5 x 32)</td>
<td>512</td>
<td>(2^{64} - 1)</td>
<td>80</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or</td>
<td>&lt;80 collisions found</td>
<td>-</td>
<td>1995</td>
</tr>
<tr>
<td>SHA-2</td>
<td>SHA-224</td>
<td>224</td>
<td>256</td>
<td>512</td>
<td>64</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or, Shir</td>
<td>112</td>
<td>159</td>
<td>2001</td>
</tr>
<tr>
<td>SHA-3</td>
<td>SHA-256</td>
<td>256</td>
<td>256</td>
<td>512</td>
<td>64</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or, Shir</td>
<td>112</td>
<td>159</td>
<td>2001</td>
</tr>
<tr>
<td>SHA-4</td>
<td>SHA-384</td>
<td>256</td>
<td>256</td>
<td>512</td>
<td>64</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or, Shir</td>
<td>112</td>
<td>159</td>
<td>2001</td>
</tr>
<tr>
<td>SHA-5</td>
<td>SHA-512</td>
<td>256</td>
<td>256</td>
<td>512</td>
<td>64</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or, Shir</td>
<td>112</td>
<td>159</td>
<td>2001</td>
</tr>
<tr>
<td>SHA-6</td>
<td>SHAKE-128</td>
<td>128 (7 x 32)</td>
<td>128</td>
<td>128</td>
<td>2(^{64})</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or, Shir</td>
<td>128</td>
<td>159</td>
<td>2001</td>
</tr>
<tr>
<td>SHAKE-256</td>
<td>SHAKE256</td>
<td>256</td>
<td>256</td>
<td>128</td>
<td>2(^{64})</td>
<td>And, Xor, Rot, Add (mod 2(^{128})), Or, Shir</td>
<td>128</td>
<td>159</td>
<td>2001</td>
</tr>
</tbody>
</table>

**P. RSA-AES Hybrid Algorithm**

In this a combination of AES (Symmetric) and RSA (asymmetric) is implemented. Its implementation is as shown in the figure below.

![Figure 11: Data & Key Sharing in Hybrid Cryptography](image-url)
Other than this hybrid cryptographic combination, various other combinations are also available namely RSA-DES, RSA-Blowfish, 3DES-AES etc.,. The choice of the hybrid algorithm depends on the application for which it is utilized.

Table 2 figures the time taken (ms) by various symmetric algorithm in encrypting or decrypting the files of different sizes.

<table>
<thead>
<tr>
<th>File Size</th>
<th>AES Enc. time (ms)</th>
<th>AES Dec. time (ms)</th>
<th>DES Enc. time (ms)</th>
<th>DES Dec. time (ms)</th>
<th>3DES Enc. time (ms)</th>
<th>3DES Dec. time (ms)</th>
<th>Blowfish Enc. time (ms)</th>
<th>Blowfish Dec. time (ms)</th>
<th>RC2 Enc. time (ms)</th>
<th>RC2 Dec. time (ms)</th>
<th>RC4 Enc. time (ms)</th>
<th>RC4 Dec. time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1mb</td>
<td>15</td>
<td>42</td>
<td>36</td>
<td>53</td>
<td>121</td>
<td>114</td>
<td>19</td>
<td>24</td>
<td>37</td>
<td>38</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>2mb</td>
<td>32</td>
<td>100</td>
<td>90</td>
<td>93</td>
<td>224</td>
<td>241</td>
<td>58</td>
<td>38</td>
<td>87</td>
<td>61</td>
<td>55</td>
<td>41</td>
</tr>
<tr>
<td>5mb</td>
<td>108</td>
<td>88</td>
<td>185</td>
<td>261</td>
<td>511</td>
<td>628</td>
<td>93</td>
<td>183</td>
<td>192</td>
<td>245</td>
<td>43</td>
<td>37</td>
</tr>
<tr>
<td>10mb</td>
<td>178</td>
<td>180</td>
<td>430</td>
<td>412</td>
<td>1090</td>
<td>1124</td>
<td>250</td>
<td>237</td>
<td>404</td>
<td>316</td>
<td>99</td>
<td>97</td>
</tr>
<tr>
<td>15mb</td>
<td>195</td>
<td>196</td>
<td>544</td>
<td>553</td>
<td>1513</td>
<td>1578</td>
<td>288</td>
<td>348</td>
<td>553</td>
<td>441</td>
<td>120</td>
<td>142</td>
</tr>
<tr>
<td>20mb</td>
<td>338</td>
<td>399</td>
<td>811</td>
<td>872</td>
<td>2089</td>
<td>2168</td>
<td>505</td>
<td>463</td>
<td>822</td>
<td>660</td>
<td>292</td>
<td>246</td>
</tr>
</tbody>
</table>

Below figure 13 illustrates the performance of each algorithm with respect to different file sizes and time taken in milliseconds.
Table 3 depicts the time taken (ms) by various hybrid algorithm in encrypting or decrypting the files of different sizes. We have experimented hybrid of RSA-AES, RSA-Blowfish and RSA-RC2 for comparison.

**Table 3: Hybrid Algorithm Performance**

<table>
<thead>
<tr>
<th>File Size</th>
<th>RSA_AES</th>
<th>RSA_Blowfish</th>
<th>RSA_RC2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enc. time (ms)</td>
<td>Dec. time (ms)</td>
<td>Enc. time (ms)</td>
</tr>
<tr>
<td>1mb</td>
<td>16</td>
<td>19</td>
<td>23</td>
</tr>
<tr>
<td>2mb</td>
<td>31</td>
<td>79</td>
<td>51</td>
</tr>
<tr>
<td>5mb</td>
<td>80</td>
<td>103</td>
<td>111</td>
</tr>
<tr>
<td>10mb</td>
<td>158</td>
<td>179</td>
<td>214</td>
</tr>
<tr>
<td>15mb</td>
<td>250</td>
<td>227</td>
<td>286</td>
</tr>
<tr>
<td>20mb</td>
<td>370</td>
<td>377</td>
<td>553</td>
</tr>
</tbody>
</table>

Below figure 14 illustrates the performance of each hybrid algorithm with respect to different file sizes and time taken in milliseconds. Performance of RSA-AES in terms of time is better compared to RSA-Blowfish and RSA-RC2.

![RSA Hybrid Performance Graph](image)

**Figure 14: Hybrid Algorithm Performance Graph**

Table 4 demonstrates the time taken (ms) by various hash algorithm in generating the hash of the files of different sizes. We have experimented with MD5 and various variants of SHA for comparison.

**Table 4: Performance of Hash Algorithms**

<table>
<thead>
<tr>
<th>File Size</th>
<th>MD5</th>
<th>SHA1</th>
<th>SHA2 (224)</th>
<th>SHA2 (256)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1mb</td>
<td>2mb</td>
<td>5mb</td>
<td>10mb</td>
</tr>
<tr>
<td>1mb</td>
<td>7</td>
<td>13</td>
<td>34</td>
<td>96</td>
</tr>
<tr>
<td>2mb</td>
<td>8</td>
<td>17</td>
<td>46</td>
<td>129</td>
</tr>
<tr>
<td>5mb</td>
<td>13</td>
<td>26</td>
<td>67</td>
<td>168</td>
</tr>
<tr>
<td>10mb</td>
<td>13</td>
<td>26</td>
<td>66</td>
<td>190</td>
</tr>
</tbody>
</table>
Below figure 15 illustrates the performance of MD5, SHA-1 and SHA-2 variants with respect to different file sizes and time taken in milliseconds. Performance of SHA2 (512) is better than other variants due to high level of security and less time consumption.

![MD5, SHA-1 & SHA-2 Performance](image)

*Figure 15: Hash Algorithms Performance Graph*

Below figure 16 illustrates the performance of various variants of SHA-3 hashing algorithm with respect to different file sizes and time taken in milliseconds. Performance of SHA3 (384) is better than other variants due to high level of security and less time consumption.

![SHA-3 Variants Performance](image)

*Figure 16: SHA-3 Variants Performance Graph*
Table 5 demonstrates the time efficiency (ms) of various curve variants of ECDH (SEC). We have experimented with NIST specified variants of ECDH (SEC) only for comparison.

**Table 5: ECDH (SEC) Curve Efficiency Comparison**

<table>
<thead>
<tr>
<th>ECDH (SEC)</th>
<th>Size (in bits)</th>
<th>Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>secp192k1</td>
<td>192</td>
<td>772</td>
</tr>
<tr>
<td>secp192r1</td>
<td>192</td>
<td>785</td>
</tr>
<tr>
<td>secp224k1</td>
<td>224</td>
<td>819</td>
</tr>
<tr>
<td>secp224r1</td>
<td>224</td>
<td>808</td>
</tr>
<tr>
<td>secp256k1</td>
<td>256</td>
<td>841</td>
</tr>
<tr>
<td>secp256r1</td>
<td>256</td>
<td>823</td>
</tr>
<tr>
<td>secp384r1</td>
<td>384</td>
<td>952</td>
</tr>
<tr>
<td>secp521r1</td>
<td>521</td>
<td>1117</td>
</tr>
</tbody>
</table>

Figure 17 illustrates the time efficiency (ms) of various curve variants of ECDH (SEC). Performance of secp256r1 i.e. 256 bits variant, comes slight better in comparison to other variants.

**Conclusion**

Data security is a challenging task in today’s scenario where cyber criminals are trained with latest hacks and tricks. Management of information on servers and maintenance of privacy are key challenges faced by cloud service providers. In this paper we did a brief review of literature related to cryptographic techniques for data security and tried to evaluate various cryptography algorithm in terms of their efficiency. Results indicate that hybrid algorithms are able to achieve high security as well as efficiency. Even a new variant of SHA i.e. SHA3 shown good performance among its peers that can be considered a good candidate for digital fingerprinting or authentication. In future, optimization techniques such as PSO or Genetic Algorithm can be integrated with symmetric algorithms for more efficient operations.

**Ethical Clearance** - Not required

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Conflict of Interest - Nil

References


Microblogging based Sentiment Analysis Using R Programming

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Abstract

This Most popular websites that have social aspects are Face book, Instagram, twitter etc. Micro blogging is a web service that allows the subscriber to broadcast messages to other subscribers of the service, example of such micro blogging web service is provided by twitter. The process of identifying human emotions and thinking is termed as sentiment analysis, which is also known as opinion mining. In this paper we will discuss about the varied kind of information which is evolved from micro blogging websites such as twitter and also we will discuss about how to create word cloud and how we will perform sentiment analysis on the real time extraction of tweets from twitter by using R programming. In this paper we will discuss about the practical implementation of the automatic sentiment analysis based recommender system on cloud using R programming.

Keywords— Micro blogging, Sentiment Analysis, Social Networking, word cloud, Recommender System.

Introduction

This Now a day’s people share their experiences and thoughts through social networks. Micro blogging sites such as twitter etc are the sources for the people to express their thoughts and feelings, where business marketing companies, politicians, social psychologists, researchers etc analyze the tweets or posts on various topics they take better decision choice[1].

Sentiment analysis is a technique, we can achieve this task by using three types of approaches such as Machine learning approach, Rule based approach and Lexicon based approach [2] [3]. In this paper we achieve the sentiment analysis task by means of lexicon based approach. This approach is an unsupervised learning classification, where we can extract the emotions along with sentiment polarity of the words using high quality, moderate sized emotion lexicon using Mechanical Turk [4]. By using this approach we can automatically detect emotions such as joy, sadness, fear, anger and surprise including with positive and negative opinions.

Business Analytics spend a lot of time on understanding opinion and thoughts of the customer about their product and services. In order to understand the customer opinion, sentiment analysis technique is used. Based on the result of sentiment analysis they can take better decisions. The source of text data we used for analysis is twitter tweets, where people interested or working on their specific area can retrieve timely feedback.

Recommender System is a technique that provides suggestions for items to be of use to a user [5]. Recommender Systems support the users to make decisions regarding their preferences about the product or item. Automatic Recommender System on cloud can recommend products or items by providing the opinions or recommendations about the product based on queries of the user, which is provided through cloud platform. The cloud platform is a very good platform for people to express their opinions and emotions towards the products and items. In this paper Social media such as twitter will act as a good cloud platform for the Recommender System.
Literature Survey

Recommender Systems are used to build recommendations by processing information from actively gathered various kind of data \[5\]. Here the data that is used for processing information was depending up on the type of the recommender system. A recommender system uses the previous history about the data to predict the likes and interests of the user \[6\].

The recommendation engines are categorized into two based on the recommenders engine algorithms. These two are user-based and item-based recommenders. We can apply filtering techniques on these recommenders. There are mainly two techniques based on the recommendations. They are Collaborative and Content-based filtering. Collaborative filtering technique provides recommendation based on the knowledge of users relationship with items, products and services. Whereas Content-based filtering technique based on the attributes of items. Based on the characteristics of these two filtering techniques, another new filtering technique called hybrid filtering technique came into existence. The application of these two filtering techniques will be applied in hybrid filtering technique based on the need \[7\].

Sentiment analysis technique plays an important role in building a recommender system. Sentiment analysis is one of the popular technique in the field of Natural Language Processing \[8\][9]. It classifies whether the given term or sentence or document either positive or negative. In some cases it also determines neutral polarity based on the level of analysis. This technique includes different levels of analysis. Mainly three levels of analysis are considered such as Document level, Sentence level and Aspect level. Document level sentiment analysis conveys the opinion of the entire document as either positive or negative. Sentence level sentiment analysis conveys the opinion of the sentence as positive, negative or neutral. Whereas Aspect level sentiment analysis convey the opinions or emotions at each level.

Position of terms i.e. words or n-grams in sentence or document plays an important role in classification process of sentiment analysis. The position of the term determines the polarity and also sometimes it reverses the polarity of the phrase. For example the term ‘bad’ makes the sentence as negative polarity whereas the term ’not bad’ reverses the polarity of the same sentence as positive.

Micro-blog services such as twitter will generate huge volumes of data every day, which allow user to broadcast their opinions, comments on various topics, items, products etc, in the form of short-text messages. This kind of data will act as a source of recommendation data. The kind of data that is extracted from these micro-blog services is unstructured data \[10\]. Application of sentiment analysis technique on automatic extraction of reviews etc from micro-blog has been served as an decision support system for the recommender systems on cloud.

Many papers are available on Recommendation System using different platforms. In \[11\] authors proposed a LASA framework, which provides to get a personalized recommendations built on previous knowledge of the user. In \[12\] author proposed a Keyword-Aware Service Recommendation Method on Map Reduce for Big data Applications. In this method they used collaborative filtering algorithm. In \[13\] authors proposed ranking and rating based approaches by using prediction on cloud services. In \[14\] author proposed a recommender system based on usage history and quality of service. In \[15\] author proposed a personalized recommender system using machine learning based sentiment analysis over social media data. In this approach they applied both context based and preference based searching in order to increase accuracy of the results.

SYSTEM MODEL

Recommender System is a technique, which provides suggestions for items to be of use to a user. The techniques that involve in recommender system include information retrieval which is an instance of a data mining technique. This technique also involves various fields such as Artificial intelligence, Information technology, Statistics, Decision Support System etc. In this paper the data mining technique include text mining based on the query of the user that extracts information from the cloud platform such as Twitter API. These extracted tweets based on geo location. The tweets that are extracted will be preprocessed and perform sentiment analysis. The sentiment analysis technique provides sentiment scores and also provides emotions and opinions regarding the answers to the queries provided by the user on the cloud. These emotions and opinions will act as recommendations to the user. We provide the
emotions and opinion scores visually, so that the user can decide whether the person had to choose the product or not. The main key role played technique in this paper is sentiment analysis, which acts as decision support system. Based on the sentiment analysis technique we can visually classify the emotions based on their score. The model was clearly represented in figure 2 shows the interaction between the cloud and the learning system.

2) Preprocessing and filtering Tweets: The tweets that are extracted from twitter are a raw and unstructured data [16] [17]. For better performance the data is to be cleaned. Before cleaning we extract only textual data of the tweets by using getText function in R programming. We clean the textual data by using the ‘gsub’ function to remove URL’s, hash tag, @ symbols etc.

3) Creating Word corpus and cleaning textual data: After filtering textual data we create word corpus then we will perform actual cleaning of the data by removing punctuation, converting the text to lowercase and also we will remove stopwords and also we will strip whitespace.

4) Creating Word cloud: word cloud is a text mining method; it highlights the most frequently used words provided in textual data. Word cloud is also referred to as text cloud or tag cloud. Generally this word cloud is used by researchers, marketers, educators, analysts and social media sites to analyze the customer needs and user sentiments. In R programming we create word cloud by using ‘wordcloud’ package.

Performing Sentiment Analysis Using R Programming

Sentiment analysis technique is used to find the human opinion and feelings through the provided textual data; here the source of the textual data is extracted tweets from twitter. The accuracy of the sentiment analysis depends on how fully the words in the tweets are included. In this section we will discuss how to extract sentiment and sentiment derived plot arcs from the preprocessed tweets by using the ‘syuzhet’ package in R.

1) Providing Sentiment Scores: Calculating sentiment scores by providing input text features to the ‘get_nrc_sentiment’ function, which calls the NRC sentiment dictionary to calculate the presence of eight different emotions and two sentiments. This function provide values to the emotions and sum up the values that having the same emotion takes the maximum score.

2) Plotting the graph based on Sentiment Scores: Based on the sentiment scores we can calculate ten different emotions, classified as “anger”, “anticipation”, “disgust”, “fear”, “joy”, “sadness”, “surprise”, “trust”,

Figure 1. Process of Sentiment analysis based Recommender system on cloud using R programming.

Figure 2. Model that shows the interaction between the cloud and the learning system.

Methodology Description

Process of Text Mining Using R Programming

1) Extraction of Tweets: To extract tweets from twitter, first we have to create twitter account and we have to register API using twitter account. We can get application details from the created App. The data is collected using ‘twitterR’ and ‘RCurl’, these two R packages allows us to access the tweets from twitter. We can request the tweets by using the ‘searchTwitter’ function that contains the area of search, time, number of tweets and language and geo location. The extracted tweets are written into a .csv file format.

3) Preprocessing and Cleaning Textual Data: After filtering textual data we create word corpus then we will perform actual cleaning of the data by removing punctuation, converting the text to lowercase and also we will remove stopwords and also we will strip whitespace.

4) Creating Word Cloud: Word cloud is a text mining method; it highlights the most frequently used words provided in textual data. Word cloud is also referred to as text cloud or tag cloud. Generally this word cloud is used by researchers, marketers, educators, analysts and social media sites to analyze the customer needs and user sentiments. In R programming we create word cloud by using ‘wordcloud’ package.
“negative”, “positive”. We can visually show different emotions. Based on the emotions, user can easily understand whether he had to choose the product. These emotions and opinion will act as decision support system for the product recommendation.

**Results and Discussion**

To test the proposed system we used Twitter API, where it is used to extract the tweets based on the query asked by the user. Twitter is a one of the micro blogging site, where people can share their views about product or an item or anything. Based on the user preference geo location, we can extract real time tweets from that geo location. Entire the experiment was conducted by using the machine learning language such as R programming. In this paper we clearly discussed about the packages and their related functions that are used to perform this experiment using R programming.

The results that are shown below are related to the iphone8 tweets that are extracted based on the query. The below results in figure 3 shows word cloud, which visually shows the most frequent words are used in tweets that extracted from twitter. Whereas figure 4 shows the sentiment scores of different emotions including positive and negative opinions. These sentiment scores are obtained after performing sentiment analysis technique on the extracted tweets related to the query. If we observe the table in figure 4, positive opinion having highest score and anger emotion is having lowest score.

The results in figure 5 visually show the plotted scores based on the emotions and opinion of the extracted tweets. The plot with different colors shows different emotions with different scores. By seeing this plot, user can easily make decision regarding the query he had asked.

<table>
<thead>
<tr>
<th>emotion</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>anger</td>
<td>22</td>
</tr>
<tr>
<td>anticipation</td>
<td>522</td>
</tr>
<tr>
<td>disgust</td>
<td>367</td>
</tr>
<tr>
<td>fear</td>
<td>141</td>
</tr>
<tr>
<td>joy</td>
<td>510</td>
</tr>
<tr>
<td>sadness</td>
<td>142</td>
</tr>
<tr>
<td>surprise</td>
<td>439</td>
</tr>
<tr>
<td>trust</td>
<td>487</td>
</tr>
<tr>
<td>negative</td>
<td>167</td>
</tr>
<tr>
<td>positive</td>
<td>694</td>
</tr>
</tbody>
</table>

**Conclusion**

This paper presents an approach to perform Sentiment analysis using R programming based on tweets from micro blogging site twitter, which extracts tweets based on user query and also automatically classifies the eight different emotions and two sentiments (negative and positive) based on the requested tweets. In this paper we also explained about sentiment analysis based recommender system on cloud. This paper we explained visual recommendation about the product or item in the form different emotion scores where a user can make decision regarding the query raised by him.

**Ethical Clearance** - Not required

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References


Cuckoo Search based Ensemble Classifier for Predictive Analysis of Malaria Infection Scope on thin Blood Smears

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Abstract
Classification of machine learning models had an ultimate achievement by means of supervised learning, but the “state of the art models” have not yet extensively applied the “biological image data”. To categorize the erythrocytes as malaria infested or not, we categorize erythrocytes thru ensemble classification method. With this regard, the script strived to prolong our former “decision tree based binary classifier” to accomplish the ensemble classification. Training data which is given clustered into diverse groups that are based on the variety perceived in all probable features projection. Every cluster is engaged to a greater extent to train single classifier. In this esteem, morphological features and entropy-based features are included. From legitimate pathology laboratories, the investigation carried on the real time inputs and combination of benchmark datasets composed as anonymous data. Unlike the existing methods, proposal of this document executed experiments on voluminous data that proliferate in size when compared to present benchmark datasets. With the statistical assessment the execution of proposal is evaluated by comparative analysis amid the two existing models “Malaria infected erythrocyte classification based on a hybrid classifier using microscopic images of thin blood smear (Hybrid Classification Approach)” and “Scale to Estimate Premature Malaria Parasites Scope (SEMPs)” and the proposed model “Cuckoo Search Based Ensemble Classifier (CSEC)”. As depicted by the experimental study the suggested model is surpassing the two existing models.

Keywords: WHO, Geometricfeatures, Gray scale histogram, ROI, Neural Networks, Rapid diagnosis tests.

Introduction
World Health Organization (WHO) declared Malaria as one of the utmost serious humid parasitic contagious diseases. The four types of Plasmodium species¹ (Plasmodium falciparum, Plasmodium malaria, Plasmodium vivax, Plasmodium Ovale) cause this disease and this parasite exhibits complex life cycle as it involves an insect vector as well as a vertebrate host. Numerous techniques like microscopic examinations of peripheral blood smear, quantitative buffy coat, and Malaria “rapid diagnosis tests (RDTs)” are used for examining this disease. Among these techniques, microscopic analysis of stained blood smears most authenticated method in many developing countries. Two separate blood smears-thin and thick film are used for microscopic examination technique where the thin films show efficiency to identify species than the thick film. Clinical expert performs microscopic examination of blood utilizing blood smears to diagnose malaria parasites, but this process consumes more time and also depends on the expert’s expertise which questions the accuracy of the result²,³. Thus, to attain accurate malaria diagnosis, digital image processing techniques are explored⁴. However, the works⁵, ⁶, ⁷, and ⁸ presents that these days machine learning techniques contribute significantly to achieve optimum diagnostic exactness in numerous “medical imaging techniques” (ultrasound imaging, CT, MRI, and microscopy).

Related Work
The works⁹, ¹⁰, ¹¹, ¹², ¹³ contributes computerized diagnosis approach to diagnose malaria using thin blood smear microscopic images analysis. This malaria infection changes erythrocytometerological feature and considered by a unique feature (geometric features and texture features) which play a vital role to classify infected erythrocyte. Previously, malaria infected erythrocytes’ classification via microscopic images
of the blood smear\textsuperscript{12} is analyzed, and malaria parasite segmentation is addressed\textsuperscript{9,10}.

The work\textsuperscript{9} presents a novel system to detect and classify this parasite through morphological approach which uses RGB images. The detection of erythrocytes using watershed algorithm from green colored part that depends on the average size of the erythrocyte is taken from the analysis of granulometry. Identification of parasite nuclei depends on fixed structural element on the components (H and S) of HSV color space. The classification will be done using Hausdorff distance computation based on morphological operations.

Likewise, detection using peculiarity and relative size of features via feed forward propagation neural network is contributed\textsuperscript{10}. The classification of “malaria infected erythrocyte” depending specifically on geometric features ruins inefficient because the plasmodium falciparum doesn’t exhibit any changes in shape, size (geometric features). Furthermore\textsuperscript{12,13} presents the detection and characterization of malaria parasite using both geometric attributes-relative shape measurements and Hu’s moments and, colour autocorrelation, and intensity features- histogram the method\textsuperscript{14} presents infected erythrocyte detection through k-NN which is based on color pixel classification along with features characterized from normalized color space of RGB. The method\textsuperscript{15} contributes a semi-automatic method to quantify; SVM classifier to classify malaria infected erythrocytes. And these infected erythrocytes are described using features like color spatial histogram, histogram sobel histogram, gray scale histogram, and saturation level histogram. The work\textsuperscript{16} presents erythrocyte characterization using relative shape measurement, Hu set of invariant moment, gradient features, run length matrix, intensity histogram, co-occurrence matrix, flat texture, laplacian features.

In\textsuperscript{17} Hu moment is used along with first order attribute which depends on intensity histogram with classifier built on feed forward NN (Neural Networks) that performs back propagation. The work\textsuperscript{18} presents an automatic cataloging of both malaria parasite and erythrocytes. And the scholars have advised the use of segmentation process with morphological approach to extract first order features; used tree classifier for discriminating both erythrocyte and malaria parasite. The work\textsuperscript{19} presents division of malaria parasite identification into subproblems (detection of “region of interest”), feature extraction, classification, and division of erythrocyte).

Using HSI color space, erythrocyte segmentation is performed depending on the color segmentation, to detect ROI (region of interest). Lastly, the classification of infected and normal erythrocytes is performed based on threshold approach that uses “chromatin dot stained” pixels and “ring part stained” pixels percentage along with the value channel standard deviation of the HSV representation of ROI which is considered as thresholding criteria. The work\textsuperscript{20} presents a system to detect malaria parasite with the use of k-means clustering technique with various color models (C-Y, HIS, and RGB) Analysis of various color models is performed to select optimal component that delivers better segmentation. After obtaining optimal color component, for removing unnecessary artifacts from the image of segmented, the seeded region increasing zoneminigmat and median sieving is done. The model depicted in\textsuperscript{21} detects the state of the given erythrocytes are prone to malaria or normal, which is using support vector machines that trained on statistical features. Contemporary studies\textsuperscript{22,23,24} presents several textural features such as entropy, LBP, histogram features GLCM, fractal dimension; morphological features such as Hu’s moment and shape features to classify infected erythrocyte using SVM, multilayer perceptron and Naive Bayes classifiers. The work\textsuperscript{25} proposes a framework formalaria parasite images textural classification. Use of rule-based algorithm for erythrocytes segmentation and parasite region is deliberated. The work\textsuperscript{26} proposes the extraction of features (nucleo-cytoplasmic ratio, Euler number, and nuclear density) and feeding SVM classifier with ‘rbf’ kernel for classifying these parasites. Further, use of Computer assistance for normal and infected Plasmodium Vivax erythrocyte classification that depends on morphological and textural features is explained. The work\textsuperscript{27} presents the feeding of extracted features using feature selection process (t-test, Class conditional density plot, Box wisker plot,) to subdue over fitting issue and then multivariate regression model usage to classify them. The contributions\textsuperscript{28,29} contributes several malaria diagnostic methods that detect these parasites automatically and Plasmodium parasites classification depending on artificial neural network. The work\textsuperscript{30} discusses a probability of k-means grouping technique which is based on the detection of infected erythrocyte in thin blood smears. The work\textsuperscript{31} presents to examine malaria in thin films of blood smears.
an “image processing algorithm” is used and to classify the normal erythrocyte and infected erythrocyte an “SVM classifier” is used. Latest contribution presents texture features (histogram, GLCM) comparative analysis to classify malaria parasites where the analysis is done on the performance of individual feature as well as and different features combinations. Literature studies depict the preparation of own database by scholar. “Database underneath academic license agreement” or “Open database” is hardly available. The work discuss that database of Cores for Prevention and Diseases Control have a few sample images, however, the number of available sample are insufficient to analyse erythrocytes with the use of machine learning based approach. Malaria specific features analysis and optimum feature group chosen for infected erythrocytes are the main demanding issue. Works present that current techniques utilize a single classifier model for erythrocyte classification. Further, to improve entire system performance, better classifier/ classifiers fusion is needed. The manuscript introduces a devised system with combination of multiple classifiers and best feature set to erythrocytes classification for optimum performance when compared to current models.

DETECTION OF MALARIA INFECTED ERYTHROCYTE USING CUCKOO SEARCH METHOD BASED ON ENSEMBLE CLASSIFIER

The present division of paper discuss methods and materials utilized in pre-processing of data, extraction of features, selection of optimal feature, and ensemble classification.

Problem Formulation and Model Description

Frequently, any classifier misclassification rate is considered as direct proportion to diverse values anticipated to chosen features that are taken as optimal features. Therefore, for such contexts diverse value projection with respect to coherence between corresponding features projected values, use of ensemble classification techniques is the recommended. Related to medical diagnosis, contemporary literature contributed computer aided models consider the input labeled data to train is considerable for values anticipated for corresponding features, but practically in real time is not possible. The same argument also applies to computer assisted models that are used to detect malaria disease. For instance, when all the accessible benchmark datasets mixed and furnished them to modern computer assisted models, the rate of misclassification is noticed as high. Therefore, this manuscript proposes a novel ensemble classification model to win over the limitation of diverse values anticipated for best features. Even in the contemporary literature presents similar model named as hybrid classification approach. This hybrid approach utilizes various classifiers (KNN, SVM, and Naive Bayes). This hybrid strategy allows these classifiers to train on the selected optimal features; all classifiers perform the classification of input unlabeled records. Furthermore, KNN, SVM, and Naive Bayes classifiers’ classification ratios are used to do input unlabeled records predictive analysis. But, this hybrid method considers limitation (projection of diverse values for optimal features) because this limitation caused high misclassification rate. Dissimilar to this hybrid model, the manuscript proposed model clusters the obtained values of optimal features depending features similarity evinced in their value patterns. Furthermore, every emerging cluster gets trained individually of the proposed classifier which is discussed in the scholar’s previous contribution. `Scale to Estimate Premature Malaria Parasites Scope (SEMPS) for malaria infected erythrocyte detection’. Then, a scale is explored from the statistics of the classification all the classifiers and later it is utilized to conduct input unlabeled records predictive analysis to know the infected and normal state of erythrocytes.

Method and Materials

The present division of paper discuss methods utilized in image pre-processing, selection of optimal feature, exploration of adapted features

RGB to Grayscale by PCA

First, obtains degree of angles among axes representing Red, Green and Blue. Then, the cosine values of the corresponding degrees are altered to values of grayscale.

\[
xr = \sum_{i=0}^{j_0} x(r_i)
\]

\[
yg = \sum_{i=0}^{j_0} y(g_i)
\]

\[
zh = \sum_{i=0}^{j_0} z(h_i)
\]

\[
mw_{x,y,z} = \frac{xr + yg + zh}{\sqrt{x^2 + y^2 + z^2}}, \quad \ldots (Eq 1)
\]
Here, the (Eq 1) is used where $m_{vw}(x,y,z)$ represents mean of absolute weights that includes every pixel of Red, Green and Blue of the specified image. And the aggregate weights are denoted as $xr, yg, zb$ and I is the order of $x, y, z$ specified for corresponding $r, g, b$ of total pixels.

Gamma Equalization

In microscopic images, poor illumination is major limitation to optimal segmenting. So, to improve the selected image contrast, gamma equalization is adapted. This is performed using the (Eq 2):

$$f(x, y) = g_{\max}(x, y) \left[ \frac{(g(x, y) - g_{\min}(x, y))^\gamma}{(g_{\max}(x, y) - g_{\min}(x, y))^\gamma} \right].$$

(Eq 2)

Median Filter

The work presents the main objective of median filter that is to run to replace every entry with the median of the neighboring entries through Window i.e. sequence of neighbors. The preceding and following entries are the superior window for 1D signal, however for 2D or more than 2D dimensional signals, there is scope for high complex window sequencing.

For a window with odd number of entries, the median deriving is a simple process- sorting entries middle value in the window in the numeric manner. Nevertheless, for even number of entries, there is a scope to obtain more possible median values.

Gaussian Filter

The work presents Gaussian-smoothing operator-2-D convolution operator that is adapted for blurring images to eliminate all sort of noise as well as detail which is termed as mean filter. However, a separate kernel is used to denote bell curve with points spanned. The Gaussian smoothing is accomplished using convolution that considers the input image as a discrete pixels set.

Fundamentally, Gaussian distribution value is nonzero in anyplace; Gaussian distribution needs infinitely large convolution kernel. But, practically its value is zero or greater than the three standard deviations. Thus, there is need to truncate kernel.

Canny Filter based Edge Detection

The work proposes a method to extract resourceful information from various visionary objects. It also decreases data quantity which is needed for processing and it is adapted intensely in several computer aided systems and can be implement effectively in edge detection solution to address demands in multifaceted situations.

K-Means clustering by optimal centroids

One of the most used clustering algorithm is K-means algorithm, however its main limitation is to select optimum centroid from initial centroids. The model depicted in proposed K-means clustering is adopted in the manuscript for clustering the specified input image where the selection of optimal centroid selection is performed using (Eq 3):

$$\max(A_i) \min(A_i) \quad \ldots \ldots \quad \text{(Eq 3)}$$

This equation $ICR(A_i)$ represents the boundaries of the values projected for attribute $A_i$ for initial centroids of the clusters.

So that initial cluster center of every attribute is measured and denoted as

$$ICR = \{ICR(A_1), ICR(A_2), \ldots, ICR(A_n)\}$$

Furthermore, the k clusters initial centroids are evaluated in the following steps:

For $k = 1, 2, \ldots K$ // intended each value from 1 to K

$C_k = \phi$ // null set denoting centroid $k$

For $i = 1, 2, \ldots, n$ // intended every attribute

$C_k \leftarrow \min(A_i) + (k - 1) \times ICR(A_i)$

End//of step 3

End //of step 1

Dual tailed t-test

Through selecting feature that are limited to labels and presents underneath infected and normal labels and have diversity in distribution (optimal features) of corresponding labels, the feature optimization is done.
Contributes dual tailed t-test to find the features distribution diversity which are present in two labels. Dual tailed t-test description is explained below:

For estimating distribution diversity values projected for features underneath two labels, the ANOVA standard dual tailed t-test is used. Vector $v_1$ represents values projected for features in infected records; and vector $v_2$ denotes values projected for similar feature in normal records. Next, two vectors $v_1,v_2$ distribution diversity is assessed using dual tailed t-test and the process is as follows in (Eq 4):

$$t-score = \frac{\left(\bar{v}_1 - \bar{v}_2\right)}{\sqrt{stdev(v_1) + stdev(v_2)}} .... (Eq\ 4)$$

In equation-1

Two vectors $v_1,v_2$ mean values are found and represented as $\langle v_1 \rangle, \langle v_2 \rangle$

Two vectors $v_1,v_2$ mean square distance is depicted as $stdev(v_1),stdev(v_2)$.

Dual tailed t-test means relative vectors’ ratio between mean variation and total mean square distance square root. Degree of probability (p-value) is taken from t-table. p-value represents vectors variance and the p-value is low with regard to threshold probability. Hence, the model optimal feature of corresponding vectors is size $n$ input parameter patterns.

Ensemble Classification through cuckoo search

The scholar previous contribution developed a cuckoo search based binary classifier. It is used for labeling the specified erythrocyte as normal and malaria infected. Using previous knowledge, this manuscript presents the development of an ensemble classification strategy for conquering the constrains of mono classifier model. Here, in the present section, building an ensemble classification strategy that involves clustering of feature set, classifiers training to incorporate in the model, and input unlabeled erythrocyte records into infected or normal is discussed.

Clustering the features

X-means enables to define the dynamic number of clusters which is adapted to cluster the set $ppv_{yr}$ into possible number of clusters dynamically.

Training Phase: Formatting Nest Hierarchy

Here, binary classification training phase process using Cuckoo Search is explained. In this phase, nests are built and nodes are linked as appropriate entries. The nests are built in hierarchy and the maximum size $n$ feature patterns are chosen as best feature which connects to the particular nest and denoted as nodes. This connected node resides the $r$th hierarchical level. Likewise, with size $n-1$ the selected feature sets (optimal features) are connected to existing nest at $2nd$ hierarchical level. Therefore size $n-1$ feature sets are connected to existing nest at $(i+1)^{th}$ hierarchical level and minimum size feature sets with size 2 are linked to current nest to final level.

Every cluster of the training set has hierarchy where nests are built in an ascending order for example hierarchy first level has one nest and second level has 2 nests and $m^{th}$ hierarchy level has $n$ nests. When $k$ is length of specified feature sets records, then $k$ length of feature patterns are 1, $k-1$ length feature patterns possible number is 2 ($\{\text{set}\ (1), \text{set}\ (2), \ldots, \text{set}\ (k-1)\}, \{\text{set}\ (2), \text{set}\ (3), \ldots, \text{set}\ (k-1)\}, \ldots, \text{set}\ (k)\})$, and finally, $k-i$ length feature sets possible number is $i+1$. The same size feature depicts various pattern from the specified feature records, however, these patterns are same equal because the call position in the specified record presents at the beginning and ending pattern differ from a feature pattern to other feature pattern which has same size. Thus, feature patterns length k-1 from size k of feature record $\{\text{call}\ (1), \text{call}\ (2), \ldots, \text{call}\ (k-1)\}$, $\{\text{call}\ (2), \text{call}\ (3), \ldots, \text{call}\ (k-1)\}$, $\{\text{call}\ (k)\}$, Based on records existing at $1^{st}$ position of specified record, the first feature pattern begins and ends with call present at $(k-1)^{th}$ position of input record. But, the $2^{nd}$ feature pattern starts with call present at $2^{nd}$ position in the input record and ends with the call at $k^{th}$ position of its source record.

Therefore, the nest hierarchy has nests where $m^{th}$ hierarchical level has $m$ nests; every nest denotes size $n-(m-1)$ of feature patterns. The feature pattern maximum length is $n$ and this hierarchy first nest denotes size $n-(m-1)$ of feature patterns which starts with the call
present at 1\textsuperscript{st} position of the input feature record. Likewise, same level \(i\)\textsuperscript{th} nest of hierarchy has feature patterns which begin with the call present in \(i\)\textsuperscript{th} position of input record.

Based on the nest formation, the feature patterns representation of normal blood smears, and infected erythrocytes, the proposed model constructs 2 nest hierarchies \(IH, NH\) that are corresponding to infected feature patterns and original feature patterns.

Once constructing nest hierarchies to every cluster with apt feature patterns that are linked as nodes with corresponding nests. To evaluate the fitness of source record for predicting the scope of malaria, the classification is performed.

Now consider that the two
\[ VNH = \{v_{c_1}, v_{c_2}, \ldots, v_{mc}\},\ BNH = \{b_{c_1}, b_{c_2}, \ldots, b_{bc}\} \]
sets represents the defined nest hierarchies of every cluster of source records with regard to the best features of both infected labels and normal labels. Two sets \(VNH, BNH\) size is denoted by the notations \(mc, bc\).

The hierarchynests of respective cluster hierarchy are filled with the corresponding cluster value patterns that refer respective nest feature.

Classifying

To achieve test records classification process, simultaneously, evaluation of nest hierarchy compatibility and assessment of record fitness on total nest hierarchies is performed to find the scope of infection and normal. The evaluation of fitness is done as mentioned below:

The input test record fitness as infected/ normal is evaluated through the compatible nests in the total hierarchies of the corresponding hierarchies enlisted in \(VNH, BNH\) sets. In regard to it, the classification process initial phase evinces value patterns as features from the source test record. Thus, every pattern denotes optimal feature with regard to infected and normal labels. Furthermore, a parallel search is performed on every nest hierarchies to observe the compatibility of nests.

The compatibility of a nest is considered when the derived feature of the test record for corresponding feature seems similar to any existing feature of the nest and then decides the compatibility of the nest and source test record. Thus, in the search phase, the compatible nests count for every test record is obtained. Furthermore, test record fitness is denoted using these statistics. The compatible nest ratio over all existing nests in onenest hierarchy represents fitness at the cluster horizontal order. With respect to this, test record cluster horizontal order fitness related to total nest hierarchies is evaluated and is denoted as sets
\[ VCF_R = \{f(v_{c_1}), f(v_{c_2}), \ldots, f(v_{mc})\}, \]
and
\[ BCF_R = \{f(b_{c_1}), f(b_{c_2}), \ldots, f(b_{bc})\}.\]
The notation \(f(v_{c_i})\) represents fitness at cluster horizontal order of source record \(R\) with respect to \(v_{c_i}\) (nest hierarchy). Likewise, \(f(b_{c_i})\) represents fitness at cluster horizontal order of source record \(R\) with respect to \(b_{c_i}\) (nest hierarchy). Furthermore, cluster horizontal order fitness average values evince for infected hierarchies as well as normal hierarchies; their respective root of mean square distances is evaluated and later used for labeling source record into infected/ normal. The following algorithm explains search process sequence.
For each unlabeled record $R$, define the set $eR$ that denotes the patterns of features possible from the respective record $R$.

$\forall \{vc \mid \exists vc \in VNH\}$ Begin //The nest hierarchy of each cluster defined from the records of the infected erythrocytes.

cnc = 0 // The count of nests that are compatible to the patterns exists in $eR$, which is initialized to 0.

$nc = 0$ //The count of nests traversed in search phase, which is initialized to 0.

$\forall \{\exists l \in vc\}$ Begin// each horizontal order $l$ of the nest hierarchy $vc$

$\forall \{n \exists n \in l \land l \in vc\}$ Begin //each nest $n$ of the horizontal order $l$ of the hierarchy $vc$

cn$+ = 1$ // increment nest count by 1

$\forall \{e \exists e \in eR\}$ Begin //each pattern $e$ that exists in set of patterns $eR$

if ($e \in n$) Begin //if the pattern $e$ belongs to nest $n$

cnc$+ = 1$ //increment the compatible nest count $cnc$ by 1

End
End
End

$f(vc) = cnc \over nc$ // This denotes the ratio of compatible nests against total number of nests traversed respective to the hierarchy $vc$ that denotes the fitness $f(vc)$ of the record $R$ in regard to the cluster represented by the nest hierarchy $vc$

$VCF_k \leftarrow f(vc)$ // move the fitness $f(vc)$ of the record $R$ corresponding to the cluster (represented by the hierarchy $vc$) to the set $VCF_k$

End

$\forall \{bc \exists bc \in BNH\}$ Begin //Each nest hierarchy $bc$ that derived for a cluster of normal records

cnc = 0 // The count of nests that are compatible to the patterns exists in $eR$, which is initialized to 0.

$nc = 0$ //The count of nests traversed in search phase, which is initialized to 0.

$\forall \{\exists l \in bc\}$ Begin// each horizontal order $l$ of the nest hierarchy $bc$

$\forall \{n \exists n \in l \land l \in bc\}$ Begin //each nest $n$ of the horizontal order $l$ of the nest hierarchy $bc$

cn$+ = 1$ // increment nest count by 1

$\forall \{e \exists e \in eR\}$ Begin //each pattern $e$ that exists in set of patterns $eR$

if ($e \in n$) Begin //if the pattern $e$ belongs to nest $n$

cnc$+ = 1$ //increment the compatible nest count $cnc$ by 1

End
End
End

$f(bc) = cnc \over nc$ // This denotes the ratio of compatible nests against total number of nests traversed respective to the hierarchy $bc$ that denotes the fitness $f(bc)$ of the record $R$ in regard to the cluster represented by the nest hierarchy $bc$

$BCF_k \leftarrow f(bc)$ // move the fitness $f(bc)$ of the record $R$ corresponding to the cluster (represented by the hierarchy $bc$) to the set $BCF_k$

End

$vf = \frac{1}{|VCF_k|} \sum_{i=1}^{|VCF_k|} f(vc_i)$ //the average $vf$ of the fitness of the record $R$ observed for all nest hierarchies representing the clusters of the infected records

$ve = \frac{1}{|VCF_k|} \sum_{i=1}^{|VCF_k|} \sqrt{(vf - \{f(vc_i) \exists f(vc_i) \in VCF_k\})^2}$ // finding the root mean square error $ve$ of the fitness.

$bf = \frac{1}{|BCF_k|} \sum_{i=1}^{|BCF_k|} f(bc_i)$ //the average $bf$ of the fitness of the record $R$ observed for all nest hierarchies representing the clusters of the normal records

$be = \frac{1}{|BCF_k|} \sum_{i=1}^{|BCF_k|} \sqrt{(bf - \{f(bc_i) \exists f(bc_i) \in BCF_k\})^2}$ // finding the root mean square error $be$ of the fitness values.
Discovering the record state

The given record $R$ will be labeled either as infected or as normal, which is done by scaling the average of the fitness of the record $R$ in regard to the divergent clusters of the records labeled as infected, and the average of the fitness in regard to the divergent clusters of the records labeled as normal, and their respective root mean square distances. Using conditions defined below, the record label will be defined as infected or normal.

In case any of the given conditions proved to be true, the records are labeled as infected:

\[ \text{if } (vf > bf) \]
\[ \text{if } (ve < be) \]
\[ \text{if } ((vf - ve) > (bf - be)) \]

In case any of the given conditions proved to be true the records are labeled as normal:

\[ \text{if } (vf < bf) \& \& (ve > be) \]
\[ \text{if } ((bf - be) > (vf - ve)) \]

The source record is considering as suspicious in all other situations.

Experimental Study

The Data sets

The experimental study is performed by using the microscopic images which are labeled (normal, malaria prone) from MaMic and bio-Sigdata corpuses through the guidelines depicted in\(^5\). Merely 1127 samples are used out of 1600 entire samples. The rest of the samples which are not deliberated are because of the visibility facets. From diverse diagnostic laboratories, the choosy samples along with the other 1740 samples are clustered into anonymous data. The information regarding the samples is depicted below in Table 1:

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>953</td>
<td>1276</td>
<td>2229</td>
</tr>
<tr>
<td>Testing</td>
<td>291</td>
<td>347</td>
<td>638</td>
</tr>
<tr>
<td>Total</td>
<td>1244</td>
<td>1623</td>
<td>2867</td>
</tr>
</tbody>
</table>

The simulation study is executed on 4GB RAM and i5 processor along with windows operating system. Using a “medical image processing” method FIJI\(^5\), the advanced model is presented. The process comprises of 1) pre-processing 2) segmentation 3) achieving attributes 4) choosing optimum attributes, and through java APIs comprised in FIJI, a binary classification is performed.

In this paper, to evaluate the execution of the method put forward, it is evaluated contrary to former contributions SEMPS\(^3\), and Hybrid classification method\(^4\). For testing phase and training phase, the model includes fluctuating sized of n-grams configuration of attributes. The optimum attributes which makes use for training determinations are optimized via ANOVA benchmark t-test.
Table 2: The performance metrics and resultant values from CSEC, SEMPS, and Hybrid classification

<table>
<thead>
<tr>
<th>Fold ID</th>
<th>Precision</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SEMPS</td>
<td>CSEC</td>
</tr>
<tr>
<td></td>
<td>Hybrid Classification Approach</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.893939</td>
<td>0.958333</td>
</tr>
<tr>
<td>2</td>
<td>0.889881</td>
<td>0.949102</td>
</tr>
<tr>
<td>3</td>
<td>0.872024</td>
<td>0.961765</td>
</tr>
</tbody>
</table>

a) Precision and Negative Predictive Value

<table>
<thead>
<tr>
<th>Fold ID</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SEMPS</td>
<td>CSEC</td>
</tr>
<tr>
<td></td>
<td>Hybrid Classification Approach</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.850144</td>
<td>0.927954</td>
</tr>
<tr>
<td>2</td>
<td>0.861671</td>
<td>0.913545</td>
</tr>
<tr>
<td>3</td>
<td>0.84438</td>
<td>0.942363</td>
</tr>
</tbody>
</table>

b) Sensitivity and Specificity

<table>
<thead>
<tr>
<th>Fold ID</th>
<th>Fall-out</th>
<th>Miss rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SEMPS</td>
<td>CSEC</td>
</tr>
<tr>
<td></td>
<td>Hybrid Classification Approach</td>
<td></td>
</tr>
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</tr>
<tr>
<td>3</td>
<td>0.147766</td>
<td>0.044674</td>
</tr>
</tbody>
</table>

c) Fall out and Miss rate

<table>
<thead>
<tr>
<th>Fold ID</th>
<th>ACCURACY</th>
<th>Misclassification rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SEMPS</td>
<td>CSEC</td>
</tr>
<tr>
<td></td>
<td>Hybrid Classification Approach</td>
<td></td>
</tr>
<tr>
<td>1</td>
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</tr>
<tr>
<td>2</td>
<td>0.866771</td>
<td>0.926332</td>
</tr>
<tr>
<td>3</td>
<td>0.847962</td>
<td>0.948276</td>
</tr>
</tbody>
</table>

d) Classification Accuracy and Misclassification Rate
The classification is executed in 3-folds with the given corpus. For comparing suggested model with standard models SEMPS and Hybrid Classification method, the metrics used for performance evaluation of standard models\textsuperscript{52} are Sensitivity, Precision, Specificity, Miss rate, Negative-Predictive-Value (NPV), Classification rate, and Classification Accuracy.

The Figure 1 presents the estimated accuracy of the benchmark and proposed models, classification accuracy is calculated for the suggested method CSEC is ≥ 0.92 & & < 0.95, that proves greater stability which is significantly greater than values which are noticed for SEMPS (accuracy ≥ 0.84 & & < 0.87) and Hybrid Classification Approach (accuracy).

The two Figures 2 and 3 which are depicted above demonstrated in such a way that CSEC method has surpassed when compared to standard methods- SEMPS and Hybrid classification method in both specificity metrics and sensitivity, that depicts the significance of “disease scope estimation” & “healthy scope estimation” in corresponding order. The CSEC method has surpassed over standard methods SEMPS and hybrid classification method in regard to malaria scope estimation values and showed greater estimation values ≥ 0.91 & & < 0.95 aimed at the scope of disease, and ≥ 0.94 & & < 0.96 for standard contribution parameter–sequence. Relatively, the benchmark comparison models SEMPS and hybrid classification method achieved sensitivity ≥ 0.84 & & < 0.87, ≥ 0.86 & & < 0.90 and specificity ≥ 0.85 & & < 0.88, ≥ 0.90 & & < 0.93 respectively.
Conclusion

This manuscript contributes an ensemble classifier that is built with an aim to win over the mono classifier strategy limitations. The study on contemporary models depicted that the most of the current machine learning models label source erythrocyteas infected/normal only the trained data of low volume as well as diversity of feature. The valuediversity appeared for the selected optimal features evince high misclassification rate. Thus, the proposed model Cuckoo Search-based ensemble classifier (CSEC) for malaria infected erythrocyte detection aims at clustering the feature projected values depending on the coherence of them. Furthermore, every cluster is involved in a classifier training. And all classifiers are trained by independent cluster. Then, the optimal feature values are collected for classifying unlabeled source erythrocyte records into malaria infected/normal erythrocytes. The finding of experimental study indicates the CSEC outperformance than hybrid classifier method in terms of accuracy in the classification process. Considering the manuscript contribution, the research can be extended to cluster optimization techniques for stabilizing the accuracy rate of classification on huge training corpus volume along with distribution diversity.

Ethical Clearance - Not required

Source of Funding - Self

Conflict of Interest - Nil

References


Data Aggregation and Precedence by Delay Sensitivity (DAP-DS): Data Transmission over Wireless Body Sensor Networks

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Abstract

Computer aided patient health monitoring is vital in clinical practices. In regard to this, the body wearable sensor nodes and health related data collection through these sensor nodes are playing significant role in recent past. The sensor networks built upon these body wearable sensor nodes are critical due to the delay sensitivity of the data collected and transmitted in these networks. In order to identify the diverse symptoms of patients without involving the instruments into the body, the “monitoring system” acts as an important role. In case of emergency, the total data which is produced from the health monitoring systems is transferred to “health-monitoring unit”. The diseases can be prevented by logging and analyzing the collected information. Human interference in continues monitoring of the patient health in regular time intervals for each individual is not feasible to optimize the clinical support. In this point of view, the current health care field is strongly using the body sensors which are wearable and are linked to “monitoring system”. The network which gathers the data associated to different health metrics aimed at the single patient. In this manuscript the proposal is about scheduling strategy which schedules the collected messages from varied sensors of corresponding node underneath of condemnatory objective called “delay sensitivity” of messages. To evade controller waiting time is also a proposal of this manuscript. The robustness and scalability of proposed scheduling scheme are evinced in simulation study.

Keywords: WBSN, DRINA, Retransmission mechanism, CICADA, Coverage-Aware-Clustering Protocol, Hybrid Rapid Response Routing.

Introduction

Study of WBSNs¹, referred as Wireless Body-Sensor Networks has motivated research interests and has got the higher-level attention of research community. According to the IEEE 802.15 standardizations, (task-group 6), body-sensor networks are defined as “optimization of the communication standard(s) for less power consumption devices, and performing operation in, around, or on the body of human(s) to provide support for numerous applications that include consumer electronics, medical, personal entertainment, and etc.”². WBSN comprise of various micro sized wireless sensor node(s), that are placed near, within, or the human body. These intelligent and miniaturized sensor node(s) monitor surrounded environment, human body functions, and gathers several psychological parameters such as blood oxygen levels, glucose levels, heart rate, etc. WSNs monitor individual’s health conditions irrespective of the medical risk, people with chronicle diseases, elders, disabled peoples, military field, and athletes practicing their gymnastics training are the few of examples where BSNs applications are imperative. Communication between any two or more sensor nodes is the pivot factor in a WSN. Developing the WSN routing protocol is a significant task due to the surrounded environment constraining characteristics. There are various wireless and ad hoc sensor networks routing protocols designs are proposed in¹ and³, but these are not appropriate for WBSNs with their characteristics.

Related Work

Data aggregation plays a major role in WSNs⁴, ⁶, ⁷.
and sensing data is coordinated in space and time by stationing sensor nodes in a particular area. Due to this, a smaller size data is collected by the nodes and in order to calculate distinct data aggregation proportions, many research methods are developed.

During the phase of data transmission, nodes never receive any data irrespective of the many data packets that are sent to nodes. Towards WSNs (wireless sensor networks) various convergecast algorithms are developed. During the process of data transmission to sink node from source, data magnitude of the packets is escalated with uninterrupted data aggregation flow. In order to decrease the amount of data packets, aggregation of numerous packets is essential. 28 Villas et al sensors 2018, 12164, 18 has developed DRINA which is a method of data aggregation to enhance the certainty of the packets that are transmitted on the same path. This proposed method helps in reducing the data size by increasing the possibility of data packets encountering and data are collected with more efficiency. Following is the description of the strategy: the strategy of least hop routing is elected i.e., each and every node chooses smallest hop node to sink such as the data forwarding is done to next hop. With comparison to the previous strategy, minimum hop formation to sink is varied, and if a node is in line to send data packets to sink then it chooses the routing path in accordance with the strategy of minimum hop-routing. So that the amount of node hops along this path is set at Zero and with spreading of hop, nodes data on this path route on the same path to sink and these results escalates the possibility of the data packets to route on same path.

Kim et al. developed a method to enhance the performance of data aggregation which is varied from the different methods that are described above. While data packets are transmitted to the node, instead of sending the data packets immediately it holds them for a certain amount of time. During this waiting time, nodes data packet queue is filled with the data packets that are transmitted. While there is an increase in delay, aggregation rate is increased by the usage of this method i.e., data aggregation rate is directly proportional to waiting time but there is an increase in delay due to prolonged waiting time. Test run of this method is applied on star topology networks and the authentication of theoretical claims is done by the similar tests which are imitated from this method. By restricting the scope of this application to the star networks, an optimized method for data aggregation is analyzed which is adjusted to the present practical application that consumes low energy along with a little delay.

The differentiation between the data packets generation time of sensor nodes to data packets receiving time at the sink is classified as the delay in WSNs. WSNs monitor many events and emergencies in the industrial production and the requirements to prevent delay in the WSNs is demanded, particularly in the case of real-time monitoring WSNs. Devastating consequences will occur due to the delay in data transmission and on battlefields, control of factory automation, and fire monitoring, the information that is monitored is assured to be transmitted as quickly as possible to control center in case of emergency, if not there is a critical loss of property as well as personnel during the events such as factory crash, fire and enemy invasion.

Because of energy limits and cost of manufacturing, a simplistic structure for sensor nodes is developed along with limited power for communication. Due to this, a non-reliable wireless communication among nodes is often seen and the estimated percentage occasionally is less than 60- 90 %. During such situations, methods which produce high reliability of data transmission are utilized. Such methods are categorized into different forms:

Retransmission mechanism: By using retransmission mechanism, lost data packets are retransmitted by the sender such that there is an increase in the data transmission reliability by transferring data several times.

At the time of data transmission process, a strong impact on delay is made by retransmission mechanism. Retransmission rate occurs at long intervals and this causes the increase in delay due to continuous retransmissions. A great delay in networks which have less reliability transmission rate due to the occurrence of different retransmissions. Many improved methods of retransmission mechanism are developed to decrease retransmission mechanism delay effect.

Recent researches on data aggregation delay state that aggregation of numerous data packets to one packet, and during this situation, the cycle of data collection produces a single packet. Role of the parent node is
the transmission of a single packet that is aggregated from every data packet which is generated by its branch node. During the process of the cycle, nodes use a single time slot to send data where the remaining time slots are utilized by network to monitor the receiving data. These networks have a wide usage of TDMA, and the delay is referred by the minimum number of slots that are required during the cycle of data collection. A time slot is defined as the amount of time that took by a node for sending or receiving the data packet. Several recent studies based on this field proved that there is a minimal delay generation in the schedule of data aggregation by the usage of these algorithms.\textsuperscript{14, 15}

Most of the strategies which are not structured to decrease the effect of delay also help in reducing delay effect such as strategy of multipath routing is used as an example\textsuperscript{16, 9} and this strategy for routing is developed to stop the attack on networks. Prevention of dropping the packets from the attacker is done by transmitting the data from source to sink using multiple paths for routing.

Several routing protocols are developed especially for WBSNs and the major role of these protocols is mainly focused on the functions of health care such as patient’s data transmission.

Analysis of different routing protocols for WBSNs is done in\textsuperscript{17} and it is proved that these type of routing protocols are mainly concentrated on energy efficiency. There are different categorizations of WBSNs protocols for routing, such as QoS based, query based and cluster-based protocols for routing. There are certain restrictions towards these protocols

WBSNs uses a protocol named CICADA (Cascading-Information retrieval by Controlling-Access with Distributed-slot Assignment) which utilizes distributed approach in order to perform free of collision or less collision communication. Conservation of energy is made possible in this proposed approach with the application of controlled communication and transmission of only essential information.

CACP(Coverage-Aware-Clustering Protocol) is a form of clustering protocol that improves the network lifetime by combining two features\textsuperscript{18}. Optimized clustering is the process for making energy efficiency in the entire network by using best coverage field. CACP uses a computation method to calculate the clustering that takes cost metric into consideration. With comparison to the nodes that do not cover a larger field, nodes which cover larger field is more favorable to become CHs. Moreover, CACP is incapable to completely address the endowment of timely data.

Umer, Tariq, et al \textsuperscript{19} proposed a Hybrid Rapid Response Routing for delay sensitive data transmission over body sensor networks. The model endeavored to deal the transmission of the delay sensitive data based on the priority assigned through the importance of the data collected by the body wearable sensors. However, the model evinced as promising in regard to network life time, stability and throughput, the ability of fault tolerance and process overhead were still challenging this model.

In order to deal the constraints observed in these contemporary models, this manuscript projected a routing strategy for delay sensitive data transmission over body sensor networks. The proposed model aimed to achieve the delay sensitive data routing with the ability of fault tolerance and less process complexity, which is found to be linear.

**Data Aggregation And Precedence By Delay Sensitivity**

The proposal of this manuscript is to enable the priority-based routing of the delay sensitive data in wireless body sensor networks. In regard to this the proposal partitions the data based on the delay sensitivity and tolerates the transmission failure of the one or more sensors of the node.

**Tolerance of the transmission failure sensors**

The majority contributions related to data transmission in wireless body sensor networks, the controller of the node that aggregates data from pool of sensors exists on that node often failsto transmit delay sensitive data to the sink. This is since the controller listens to sensors till they deliver the committed data, which often turns to be indefinite time in regard to failure or unresponsive sensors of the corresponding node. In regard to this argument, the proposal of the manuscript derived a novel data aggregation strategy for controller of the node.

For each sensor $s_i$ of the node, the controller determines the maximum time $mt_i$ taken to deliver the data. The maximum time $mt_i$ taken by the sensor $s_i$ is
estimated as the sum of average time taken by earlier acceptable messages delivered by that sensor and the root mean square error of that average. Further, the controller tolerates the delay in message delivery from the sensor \( s_i \) at most \( mt_i \). If the delay in message delivery from any of the sensor exceeds their maximum time \( mt_i \), then commits the data aggregation and continues further process. The description of the process follows:

The sum of the average of the max time taken by all the sensors pooled under a node and the root mean square error of that average can be termed as the maximum tolerance time \( T_n \) of the controller of the corresponding node.

The max time \( mt_i \) of the sensor \( s_i \) can be measured as follows:
\[
\langle t_i \rangle = \frac{\sum t_{is}}{sid_i} \quad // \text{average time taken by the acceptable messages delivered by } i^{th} \text{ sensor, } sid_i \text{ denotes the sequence id of the last valid message from } i^{th} \text{ sensor, } t_{is} \text{ is the time taken for } x^{th} \text{ message delivery.}
\]

The root-mean-square-error of the average \( \langle t_i \rangle \) can be defined as:
\[
e(t_i) = \sqrt{\frac{\sum (\langle t_i \rangle - t_{is})^2}{sid_i}}
\]

Then the max time \( mt_i \) that controller tolerates for message delivery from sensor \( s_i \) can be defined as follows:
\[
mt_i = \langle t_i \rangle + e(t_i)
\]

Further, the average of the max delay time \( mt \) to deliver the message by all of the sensors on corresponding node can be determined as follows:
\[
\langle mt \rangle = \frac{\sum |n| mt_i}{|n|} \quad // \text{the notation } \langle mt \rangle \text{ denotes the average of the maximum time } mt \text{ taken by all the sensors of a node } n
\]

Further the root-mean-square error \( e(mt) \) of the average \( \langle mt \rangle \) can be derived as follows:
\[
e(mt) = \sqrt{\frac{\sum |n| (\langle mt \rangle - mt_i)^2}{|n|}}
\]

Further, maximum tolerance time \( T_n \) of the node \( n \) can be defined as follows:
\[
T_n = \langle mt \rangle + e(mt)
\]

Priority based messaging

“Health monitoring device” is constructed with nodes and every node gathers prerequisite health related data from the equivalent human body. Every node is constructed by a group of sensors & a controller which gathers the information from these sensors and transfers to target environment.

The suggested method prioritizes the information gathered from the sensors for rating the “delay sensitivity”.

The data which is gathered from these sensors of node can be combined into a piled array of magnitude \(|n| +1\) in such a way that where \(|n| \) rows of given array is segregated into 5 columns, and here \(|n| \) denotes the number of sensors on specified node \( n \). Based on the information gathered from \( i^{th} \) sensor of corresponding node, the 1\(^{st}\) column of \( i^{th} \) row of stacked array is buffered, 2\(^{nd}\) column signifies the priority-id of the corresponding sensor, the 3\(^{rd}\) column of \( i^{th} \) row signifies the message sequence number which buffered in 1\(^{st}\) column of respective row, 4\(^{th}\) column signifies the “controller tolerance period”, and 5\(^{th}\) column depicts that the message which buffered is reliant on other messages/not. Priority grade of the corresponding message is defined by using inputs of the columns 2\(^{nd}\), 3\(^{rd}\), 4\(^{th}\), and 5\(^{th}\), such that sequence of the values represented in columns from low - high depicts the sequence of priority denoted as high-low. The respective order no. will be increased by 1, when each message from \( i^{th} \) sensor which buffered is successfully transmitted. To buffer the relative node’s header data, the final row \((|n| +1)^{th}\) array is utilized. Over the following properties the priority of message which buffered in the array of \( i^{th} \) row changes dynamically.

- The priority will be “high” if the sensor priority id of the corresponding message is “low”
- The priority will be “high” if the specified order id of respective message is “low”
• The priority will be “high” when the “controller tolerance period” to obtain the message from corresponding sensor is “low”

• The priority will be “high”, if the array of the any buffered messages is reliant on the corresponding message.

Let the size \(|n| + 1\) denotes array \(M\) which buffers messages of node \(n\) from \(|n|\) sensors. Corresponding to the details presented above, array \(M\) will be depicted as

\[
M = \{ \{m_i, pid, sid, lf, d\}, \{m_2, pid, sid, lf, d\}, \ldots, \}
\]

From the above representation \(\{m_i, pid, sid, lf, d\}\) comprises message \(m_i\) received from \(i^{th}\) sensor of node \(n\), \(pid\) denotes the priority id, \(sid\) denotes the sequence id, \(lf\) denotes the “controller tolerance period” to get the message \(m_i\), and \(d\) denotes dependent state of the message where 1 represents dependent and 0 represents not dependent.

Corresponding to \(n\) node, controller concludes the messages piled in \(M\) array after specified time \(T_n\) is derived (sec 3.1).

In addition, the piled messages of \(M\) array can be arranged in hierarchical order in the following way.

Arranging messages in increasing sequence of priority-id and then arranging the messages in increasing order of the sequence-id. In addition, sort the messages in increasing order of the “controller tolerance period”, and finally sort the messages in descending sequence of the dependency state.

Upon arranging the piled messages of array \(M\), messages can be transferred by controller to

Selected device in respective sequence of the secured messages in array \(M\).

**Experimental Scenarios**

AVROA, the network stimulator is used to conduct the experimental study\(^{20}\). Table-1 shows, stimulation parameters of the experimental study. The proposed model DAP-DS is compared with the new model called, HRRR in order to obtain the performance metrics, where DAP-DS is known as Data-Aggregation & Precedence by Delay-Sensitivity, and HRRR is termed as Hybrid-Rapid Response Routing\(^{19}\). The chosen performance metrics are (a) control packet-overload (b) transmission latency-ratio (c) data delivery-ratio. Complete description of performance analysis is as follows.

**Table 1: Stimulation parameters of the experimental study**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor count</td>
<td>400</td>
</tr>
<tr>
<td>Network range</td>
<td>750 sqm / m</td>
</tr>
<tr>
<td>Size of message frame</td>
<td>32 bytes</td>
</tr>
<tr>
<td>Size of data frame</td>
<td>0.5 kbps</td>
</tr>
<tr>
<td>Sink mobility latency threshold</td>
<td>3 sec</td>
</tr>
<tr>
<td>Sink mobility</td>
<td>DAP-DS selective region, HRRR random waypoint</td>
</tr>
<tr>
<td>Sink mobility range of speed</td>
<td>5 to 50 mtrs per second</td>
</tr>
<tr>
<td>Start level residual energy (each sensor)</td>
<td>1 J (J for joules)</td>
</tr>
<tr>
<td>Sleep time energy consumption</td>
<td>0.2, (10^{-9}) J (J for joules)</td>
</tr>
<tr>
<td>Idle time energy consumption</td>
<td>0.4, (10^{-9}) J (J for joules)</td>
</tr>
<tr>
<td>Receiving ingestion transmission energy consumption</td>
<td>(50, 10^{-9}) J (J for joules)</td>
</tr>
<tr>
<td>Egress transmission energy</td>
<td>(50, 10^{-9}) d J (J for joules, d for distance)</td>
</tr>
<tr>
<td>Egress transmission amplified</td>
<td>(0.7, 10^{-9}) d joules (J for joules, d for distance)</td>
</tr>
<tr>
<td>Execution time</td>
<td>720 secs</td>
</tr>
</tbody>
</table>

**Overhead of a Control Packet**

The contemporary HRRR model proposes the immense need to exchange the messages. Because control packets are meant to develop rendezvous tree, and they will update the sink present location with the involved rendezvous tree nodes. Organization of the
The proposed DAP-DS model proclaims that message exchange occurs during the route selection and region formation of sink mobility. In contrary the contemporary HRRR model demands continuous exchange of messages with respect to location update of mobile sink, whereas the DAP-DS, the proposed model operates with the chosen message exchange which will enable the rendezvous agent(s), and mobility sink direction by defining the sleep, transmission, and idle times of corresponding rendezvous agent(s) sensor plotted regions. This exercise assists to stabilize the overhead of control packets with respect to the speed of mobility sink. Additionally, the selective message exchange occurs in less number of times, because the path followed by sink mobility is distinct. Finally, the performance of overhead of control packets for the model, DAP-DS, and contemporary HRRR model are evaluated in terms of energy consumption and the metrics are drawn in Figure-1.

**Figure 1: HRRR & DAP-DS overhead of control packets**

**Energy Consumption and Transmission Latency**

The chosen models of the current research, HRRR, and DAP-DS results are manifesting lower transmission latency that resulted with the deterministic selection of sink location. The body sensors of HRRR model reach the mobile sink via the rendezvous tree, and hence optimal latency is visible. Moreover, space gap between sink and source which connected via the rendezvous tree may not be deterministic, so egress transmission’s energy consumption is often realized as infeasible. Unlike, the DAS-DS model make sure that sensors will be in idle or sleep state, until the sink is likely to become reachable, and it can be workable with the selective direction of regions that visits the sink. Additionally, the space gap between sink and source sensor is stable, and hence the egress transmissions energy consumption is also low and stable. The below figure-2 portrays the transmission latency comparison ratio for both DAP-DS and HRRR models.

**Figure 2: HRRR 7 DAP-DS ratio of energy consumption levels**

The energy consumption and exchange of messages are proportional to each other, so there is lesser energy consumption is noticed in DAP-DS rather compared to HRRR model. Rather than transmission and idle times, sensor(s) sleep times consumes less energy. The ideal approach applied in the current research with the selection of mobile sink, the rendezvous agent(s) are able to define transmission, idle, and sleep times of sensors that placed in the appropriate rendezvous agent(s) region. Additionally, HRRR model can’t provide the sensors idle time, with the time interval between the anticipated data transmission and collection. With the deterministic sleep, transmission and idle time of sensor(s) that proposed in DAP-DS model, there is a significant drop of energy consumption diffusion when compared to HRRR model. Ratio of the energy consumption with respect to the distinct speeds of sink mobility are shown in the Figure- 3

**Figure 3: HRRR & DAP-DS model’s transmission-latency ratio**

**Network Life and Packet Delivery**

The short and stable distance between the sink and
source that is possible with the selective direction of sink mobility, the two models, i.e. benchmark HRRR, and proposed DAP-DS models packet delivery potential ratio is compared, that mostly resulted sink and source long-distance transmissions. Priority of the region is aptly determined with the proposed model due to the selection of sink mobility. The conditions that defines the region priority are explained in “section 4.3” that states the possibility to balance the source-to-sink sensor(s) transmission reliability. The packet delivery ratios of HRRR and DAP-DS models are shown in the below Figure - 4.

Figure 4: HRRR & DAP-DS packet-data delivery ratio

According to the DAP-DS model, the deterministic selection of the route with respect to the regions priority ensure to obtain transmission, idle, and sleep time of sensor(s). So, the proposed model consumes very less energy and improved life span rather compared to the latest HRRR model. The total number of live sensors at distinct simulation intervals determines the simulation networks lifespan. The below drawn figure 5 shows the HRRR & DAP-DS models network lifespan.

Figure 5: HRRR & DAP-DS models network lifespan (evaluated with respect to the nodes drop)

Conclusion

The study concentrated mainly on placing the messages in order transferred to the controller node by the sensor that comprises the ability of sensor fault tolerance towards the controller. The method which incorporated the controller of node is effective and innovative to place the messages in order which are delay sensitive. Critical features utilized to place the messages in order are dependency scope, fault tolerance period, sequence id, and message sensitivity. For transferring significant data, high reliability together with short delays is evaluated in the study. Consequently, “delay sensitive messages” be supplied in order. Further the fault tolerance capacity of controller helps to lessen the delay by evading the unknown waiting time of the controller of sensor data.

Ethical Clearance - Not required

Source of Funding- Self

Conflict of Interest - Nil

References


The Outcome of Employee Commitment in Healthcare Industry

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Abstract

Objective: The demand for healthcare service is increasing due to awareness of people on the importance of health and quality of life. Hence, it has become very essential for healthcare organizations to look at strategies for quality service delivery for patient satisfaction. Among the various strategies for enhanced employee outcome, medical employee’s commitment to organization is very important. This study examined the relationship between employee commitment and its outcome in healthcare Industry.

Purpose: This paper examines the impact of employee commitment and employee outcome like intention to leave, work stress and individual performance in healthcare industry. And also to understand whether demographic variables like Age, Gender and Experience exhibit difference on Continuous Commitment and employee outcome.

Findings: A strong relationship was identified between employee’s continuous commitment and employee outcome. Intention to leave or quit is greatly affected by lack of commitment to the organization and work stress. When employee’s continuous commitment is high, and they understand the cost of leaving the organization, then turnover intension will be low.

Research limitations: The impact of employee commitment employee outcome was only measured. The important aspect patient’s satisfaction was not measured.

Practical Implications: Employees committed towards their organizations are very enthusiastic and render maximum productivity to their organization. It is evident that employees with continuous commitment understand the cost of leaving the job and need of holding the present job and so job turnover is less. This makes them highly productive. Increase in employee commitment will help health care Industry to retain employees and move ahead to experience global competition.

Keywords: Employee commitment, continuous commitment, Intention to leave, Work stress, Individual Performance

Introduction

Employee Commitment is a psychological binding of an individual to the job and the organisation. In recent years commitment has garnered a lot of attention in HR literature. Commitment is the bond employees experience with their organisation. Committed employees feel a belongingness with the organization and they understand the organization’s goals and objectives. These employees are more determined towards their work, are highly productive and are very proactive. No Organizations can be more productive and successful without committed employees. Since 1960s, employee commitment continues to be one of the most exiting issues for heads of organizations as well as researchers.

Employee Commitment

Commitment is defined generally as “the relative strength of an individual’s identification with and involvement in a particular organization”. It can be characterized by at least three related dimensions: “a strong belief in and acceptance of the organization’s goals and values; a willingness to exert considerable effort on
behalf of the organization; and a strong desire to maintain membership in the organization” (Mowday et al., 1979). Further developing the concept, (Meyer and Allen, 1984) identified three salient dimensions of employee commitment: affective, continuance and normative. Affective commitment describes an individual’s desire to stay with the organization given her/his emotional attachment to, and identification with, the organization. In traditional, ongoing employment relationships, a high level of affective commitment has been found to be related to low employee turnover, low absenteeism and improved job performance (Meyer et al., 2002). Continuance commitment describes an individual’s need to remain with the organization resulting from her/his recognition of the costs (tenure, pay, benefits, vesting of pensions and family commitment, etc.) associated with leaving the organization (Meyer and Allen, 1984). In contrast, normative commitment reflects an individual’s feeling of obligation to maintain organizational membership because he/she believes it is morally right to be loyal to, and stay in, the organization.

**Continuous Commitment**

Continuous commitment is where an employee prefers to stay in the organization mainly to satisfy his needs. He has no options available and no other sources of job alternative and losing this job is a high cost for him. Continuance commitment is regarded as an awareness of the costs associated with leaving the organization (Meyer and Allen, 1997). Because of the individual’s awareness or consideration of expenses and threats linked to leaving the organization, continuance commitment is considered to be calculative. Individuals with continuance commitment remain with a specific organization because of the money they earn as a result of the time spent in the organization, and not because they want to. Continuance commitment is related to the tendency of staying in the organization due to the expenses of turnover or benefits of staying (Meyer and Allen, 1997). In this situation, they hold the job not because they want it; they hold it for they need the job. This dimension was popularized by Becker’s side-bet theory, which defined commitment as a tendency to “engage in consistent lines of activity”. Becker (1960) based on the individual’s recognition of the “costs” associated with discontinuing the activity, they become tied to the organization because they have voluntarily or involuntarily invested in the organization (e.g., pension plans) and they cannot “afford” to leave (Mathieu and Zajac, 1990). Employees whose primary link to the organization is based on continuance commitment remain because they need to do so” (Meyer and Allen, 1991).

**Employee Commitment in Health Care Industry**

“Without employee engagement, you’re never going to get the kind of ultimate patient experience you’re hoping for.” –Mike Packnett, CEO, Parkview Health. Though there is a lot of advancements in medical technology, healthcare is still a people-intensive business.

**Employee engagement is the emotional commitment employees have to the company and its goals.** So when employees are engaged and committed to the organization and its goal, they care about the hospital, their team and their patients.

There is a significant link between employee engagement and improvements in patient care and satisfaction. For instance, higher nurse engagement scores lead to lower patient mortality and complications, according to a recent Gallup study. Just like employees in any other Industry, healthcare providers also will do better work and shall provide better care, if they are happy and committed in their jobs.

Service Organisations such as hospitals are a social system that requires human resources for its effective and efficient operations (Mosadeghrad, Ferlie, Rosenberg, 2008). It is essential for hospital to focus on their employees and keep them satisfied and committed to enhance hospital efficiency in healthcare service delivery (Velickovic et al., 2014). With organisational commitment being seen as the main area of focus in human resource management (Guest, 1998; Baptiste 2008), there is also a need to look into the employees’ commitment to ensure employees well-being which will further drive organisation performance (Baptiste, 2008).

**Employee Outcome**

According to RajendranMuthuveloo et al. (2005) Employee outcome is measured by

- Intention to leave
- Work stress
- Individual Performance
INTENTION TO LEAVE

Intention to leave refers to conscious and deliberate willfulness to leave the organization and it is defined as “individual’s own estimated possibility that they are permanently leaving the organization at some point in the near future” (Vandenberg and Nelson, 1999). Turnover intention is among the strongest predictors of actual turnover and employee commitment is one of the most important antecedents to turnover intention (Thatcher et al., 2003; Mitchel, 1981). One of the main negative consequences of turnover is the personnel costs associated with selection, recruitment, training and development of new employees to replace the employees who voluntarily quit the organization (Staw, 1980).

Work Stress

Work stress can be defined as the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker. Stress refers to an individual’s reaction to a situation or aspect of the environment that is perceived as stressful and a threat to one’s well-being. The employees work behavior is greatly affected due to stress. When organizations ignore its employees stress and needs, then the results are increased absenteeism, low productivity, low motivation and financial damages which eventually affect the work behaviour of employees.

Individual Performance

Individual performance is a spotlight within the work and managerial psychology. Throughout last decades, researchers have step forward in illuminating and developing the performance concept (Campbell, 1990). Achieving the effort to perform at a peak level can be a base of satisfaction and pride. Individual performance is a crucial outcome measure in majority of the studies.

Literature Review

Iverson and Buttigieg (1999) examined the multi-dimensionality of organizational commitment, on a sample of 505 Australian male fire-fighters. Data was collected by mailing a multi-item questionnaire. The perception of the employees was measured on five-point Likert scale. Organizational commitment was measured using the original 24-item scale developed by (Allen and Meyer, 1990). The results indicated that organizational commitment was best represented by four factors of affective, normative, low perceived alternatives and high personal sacrifice. Employees expressed different personal, job-related and environmental causes of commitment too. The model was tested by employing Linear Structural Relations.

Kontoghiorghes and Nancy Bryant (2004), identified the key predictors of employee commitment in healthcare insurance industry. Strongest predictor identified was company satisfaction followed by good working environment that motivated continuous learning.

Murali et al., (2005), investigated the relationship between employee commitment and patient satisfaction in two centres of leading medical service provider in bangalure city. A positive correlation was identified highlighting the importance of employee commitment in health care sector which is a people-centric industry.

MahmoudAl-Hussami (2009), made a study with registered licensed practical Nurses in south florida, with commitment and satisfaction to organization effectiveness. The study revealed that the more committed the employees are, the more productive they are.

His-Chi et al., (2012), explored the relationship between organization culture and organizational commitment among hospital nursing executives in Taiwan. The study revealed a high level of positive relationship between these both. Organizational culture provided a sense of identity and rules that aided in the achievement of organizational goals. Good culture enriched Organizational Commitment and hospital performance services.

Lambert et al. (2013) studied the relationship of continuance and affective commitment with employee’s life satisfaction by conducting a survey in Michigan maximum-security prison and Midwestern private maximum-security prison. Results showed that continuance commitment was negatively correlated to life satisfaction. In the private prison also, age and continuance commitment were negatively correlated with life satisfaction.

Adnan (2015), tried to analyse and determine the influence of organizational culture on Continuous
commitment and employee performance. The approach used is causality between the variables, whereas sampling techniques used was the census method with the number of respondents targeted 115 employees. The results showed that organizational culture has a positive and significant impact on Continuous commitment and employee performance.

Essono .Fabiene and Sandeep llyodkachchhap (2016), Identified the factors for enhancing employee commitment with healthcare professionals in Philippines. The factors identified were job satisfaction, working climate and training and development activities.

Israel  et al., (2017), investigated the factors influencing Organizational Commitment, because of the relationship between Organizational Commitment and employee turnover, absenteeism and organizational performance, which are all very essential for health care executives to stabilize nursing workforce. The factors influencing organizational commitment were perceived organizational support, job satisfaction, transformational leadership behaviour, educational qualification and working ward.

Research Objectives:

To identify the influence of continuous Commitment on Employee outcome.

To study whether demographic variables like Age, Gender and Experience exhibit difference on Continuous Commitment and employee outcome.

Research Design

Research design is the basis for the composition of any successful scientific work, which gives direction and standardizes the research. Descriptive research is concerned with describing the situation at the time of the study (Creswell, 1994). Descriptive approach is used to bring out the relationship between continuous commitment and Employee Outcome.

Data Collection

Both primary and secondary data were used for this study. Primary data was collected from the sample respondents through a structured questionnaire, Meyer and Allen (1990). Review of secondary literatures helped the researcher to develop research questions and objectives. Merriam (1998) stated that in order to get a comprehensive and complete perspective of the study subject one should seek secondary information from multiple sources. Accordingly, secondary data for this study were collected from journal articles, research studies, books, and authentic websites such as EBSCO, PROQUEST and EMERALD.

Data Analysis

The collected data were appropriately coded and uploaded into a computer. Statistical package for social science (SPSS) version 20 was used to process the data and for application of statistical tools. Structural Equation Modeling (SEM) was used for testing the relationships among observed and latent variables (Hoyle, 1995). Difference in the mean scores between the two gender groups was examined by independent samples T-test.

Relationship between Age and Dependent and Independent Variables

The researcher was interested in understanding the relationship between age and dependent, mediating and independent variables.

Age and Continuous Commitment

Test: One-way ANOVA test was applied to assess the difference in the continuous commitment mean scores between the four age groups of respondents.

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>365.908</td>
<td>3</td>
<td>121.969</td>
<td>4.138</td>
</tr>
<tr>
<td>Within Groups</td>
<td>9313.292</td>
<td>316</td>
<td>29.472</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9679.200</td>
<td>319</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Degree of Continuous Commitment significantly varied with the age of the employees. Particularly, employees aged between 21-25 years had lower level of Continuous Commitment when compared to other age groups.

**Age and Employee Outcome**

Test-One-way ANOVA test was applied to find the difference in the Intension to Leave mean score between the different age group of respondents.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to Leave</td>
<td>3.84</td>
<td>.44</td>
<td>.723</td>
</tr>
<tr>
<td>Work Stress</td>
<td>18.589</td>
<td>1.611</td>
<td>.187</td>
</tr>
<tr>
<td>Individual Performance</td>
<td>125.591</td>
<td>4.434</td>
<td>.005</td>
</tr>
</tbody>
</table>

One-way ANOVA test result shows that there was no statistically significant difference in the mean scores between the four age groups and employee’s outcome intention to leave and work stress as the computed p-value is greater than the critical alpha value (.05). But with regard to individual performance there is significant difference between the age groups as the as computed p-value is less than the critical alpha value (.05)

**Relationship between Gender and Dependent and Independent Variables**

**Gender and Continuous Commitment**

Test: The difference in the level of Continuous Commitment between the male and female employees was examined using independent samples t-test.

<table>
<thead>
<tr>
<th>Factors</th>
<th>t</th>
<th>Df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Diff</th>
<th>Std. Error Diff</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal variances assumed</td>
<td>-.444</td>
<td>318</td>
<td>.657</td>
<td>-.40277</td>
<td>.90685</td>
<td>-2.18695</td>
<td>1.38140</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-.416</td>
<td>32.928</td>
<td>.680</td>
<td>-.40277</td>
<td>.96895</td>
<td>-2.37428</td>
<td>1.56873</td>
</tr>
</tbody>
</table>

Results: The independent samples t-test results shows the difference in the mean score between the two groups compared is not statistically significant [t (318) =-.444, p = .657>.05], since the computed p-value is greater than the critical α value .05. Male and female employees did not significantly differed in their “Continuous Commitment” towards their organization.

**Gender Vs Employee Outcome**

<table>
<thead>
<tr>
<th>Factors</th>
<th>t</th>
<th>Df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to Leave</td>
<td>.390</td>
<td>318</td>
<td>.697</td>
</tr>
<tr>
<td>Work Stress</td>
<td>.227</td>
<td>318</td>
<td>.820</td>
</tr>
<tr>
<td>Individual Performance</td>
<td>-1.026</td>
<td>318</td>
<td>.305</td>
</tr>
</tbody>
</table>

Conclusion: From the above results, it has been concluded that there is no significant difference among the male and female employees with regard to employee outcome like intention to leave, work stress and
Relationship between Work Experience and Dependent and Independent Variables

Work Experience and Continuous Commitment

Test: Difference in the “Continuous Commitment” mean scores between the five work experience groups was analyzed with one-way ANOVA test.

Table 5 ANOVA Test Results

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>63.487</td>
<td>4</td>
<td>15.872</td>
<td>.731</td>
<td>.571</td>
</tr>
<tr>
<td>Within Groups</td>
<td>6837.385</td>
<td>315</td>
<td>21.706</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6900.872</td>
<td>319</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One-way analysis of variance statistics reveals that the differences in the mean scores between the five work experience groups compared is not statistically significant \[F(4, 315) = .731, p = .571>.05\]. “Continuous Commitment” of the employees did not differ significantly with their work experience in the organization.

Work Experience Vs Employee Outcome

Table 6 Work Experience Vs Employee Outcome

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to Leave</td>
<td>5.369</td>
<td>.618</td>
<td>.650</td>
</tr>
<tr>
<td>Work Stress</td>
<td>9.710</td>
<td>.835</td>
<td>.504</td>
</tr>
<tr>
<td>Individual Performance</td>
<td>70.984</td>
<td>2.472</td>
<td>.045</td>
</tr>
</tbody>
</table>

Conclusion: Employees, though they had varied work experience in the organization they did not have any significant difference on “Intention to Leave” and work stress. But then there was significant difference between the employees with varied work experience and their individual performance.

STRUCTURAL EQUATION MODELING

Structural Equation Modelling (SEM) is a general statistical modelling technique which is used in behavioural sciences. It comprises of factor analysis, regression and path analysis. The relationships between the theoretical constructs are represented by regression or path coefficients between the factors. They frequently summon a measurement model that defines latent variables using one or more observed variables and a structural model that implicate relationships between latent variables.

Fig 1. Continuous commitment and employee outcome

The path relationship between continuous commitment and employee outcome

The coefficient of determination, R² is .996 for Continuous Commitment. Endogenous latent variables highly explain 99.6% of the variance in Continuous Commitment.

Continuous Commitment has higher impact on Individual Performance (.399) followed by Intention to leave (.348) and Work stress (.338).

The hypothesized path relationship between Continuous Commitment and Employee Outcome like Intention to leave (ITL), Work stress (WS) and Individual Performance (IP) is statistically significant, because its standardized path coefficient (.348, .338 & .399) is greater than (0.1).

Hence it is evident that there is a strong relationship between employees’ continuous commitment and employees’ outcome such as Intention to leave, Work Stress and Individual Performance.
Table 7 Fit Indices Continuous Commitment and Employee Outcome

<table>
<thead>
<tr>
<th></th>
<th>AVE</th>
<th>Composite Reliability</th>
<th>R Square</th>
<th>Cronbachs Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>0.587572</td>
<td>0.880690</td>
<td></td>
<td>0.807998</td>
</tr>
<tr>
<td>EO</td>
<td>0.528648</td>
<td>0.916304</td>
<td>0.996301</td>
<td>0.853529</td>
</tr>
<tr>
<td>IP</td>
<td>0.526309</td>
<td>0.832923</td>
<td></td>
<td>0.761773</td>
</tr>
<tr>
<td>ITL</td>
<td>0.600199</td>
<td>0.921874</td>
<td></td>
<td>0.866237</td>
</tr>
<tr>
<td>WS</td>
<td>0.510419</td>
<td>0.959468</td>
<td></td>
<td>0.943964</td>
</tr>
</tbody>
</table>

Internal Consistency Reliability

In PLS-SEM, composite reliability is used to measure internal consistency (Bajozzi and Yi, 1988), (Hair et al, 2012). From the above table it is inferred that all values are higher than the preferred level of 0.7. Hence the reliability is high.

Convergent Validity

To check the convergent validity each latent variables Average Variance Extracted (AVE) is evaluated and it is found that all the AVE values are greater than the acceptable threshold of 0.5. So, the convergent validity is confirmed.

Findings

The study concluded a strong relationship between employee’s continuous commitment and employee outcome. Committed employees contribute a lot towards their organization and employee outcome. Employee commitment lead to several specific behavioral outcomes, such as job performance and reduced work stress. Intention to leave or quit is greatly affected by lack of commitment to the organization and work stress. When employee’s continuous commitment is high, and they understand the cost of leaving the organization, then turnover intention will be low. Continuous commitment is significant to organization performance, which manifest in employees skills, performance and devotion to duty so as to fulfil the set organizational goals and objectives. The empirical results indicate that there is fairly a high relationship between employee continuous commitment and employee performance, implying that employee commitment improves the performance of individual employees.

Conclusion

The study examined whether employee commitment affects employee outcome by influencing organizational citizenship behaviour and this behaviour influences employee outcome. Employees of the selected organizations are enthusiastic and is reflected in their continuance commitment in their work environment to render maximum productivity to their organization. It is evident that employees with continuous commitment understand the cost of leaving the job and need of holding the present job. This makes them highly productive, and with less intention to leave the job. Increase in employee commitment will also help health care Industry to retain employees and move ahead to experience global competition.

Ethical Clearance - Not required

Source of Cunding- Self

Conflict of Interest – Nil

References

8. Essono .Fabiene and Sandeep llyodkachchhap. Determinants of employee commitment among


Correlation of Serum Copper, Zinc, Magnesium with Insulin Resistance in PCOS Female of Reproductive Age Group

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Abstract

Background: Insulin resistance is common in patients with PCOS-Polycystic Ovary Syndrome. Serum copper, zinc, magnesium are measured and it is correlated with insulin resistance.

Aim of Study: The present study intended to determine correlations among insulin resistance and minerals like copper, zinc, magnesium in patients with PCOS.

Methodology: The subjects were identified from gynecology OPD of private medical college in Tamilnadu. The study involved 200 female of age 15-45 years (100 female had PCOS and the other 100 female were controls).

Results: HOMA was meaningfully higher in female with PCOS in contrast with control. There was a significant correlation of copper, zinc and magnesium with insulin resistance. It was observed that the levels of copper and zinc increases with patient showing insulin resistance while magnesium was lowered in the same.

Conclusion: There is a significant correlation between the levels of copper, zinc, magnesium and IR in patients with PCOS.

Keywords: Copper, zinc, magnesium, HOMAIR, PCOS.

Introduction

PCOS - Polycystic ovary syndrome, additionally referred to as hyperandrogenic anovulation (HA) or Stein–Leventhal syndrome is a fixed of signs and symptoms owing to a hormone imbalance in females1. Emblems and symptoms of PCOS embrace abnormal, heavy periods, no menstrual periods, facial hair, excess body zits, and pelvic pain, infertility. It is usually related to different conditions kind 2 diabetes, weight problems, cardiac diseases, endometrial most cancers2. PCOS is the maximum common endocrine disease amongst females among the a long time of 18 and forty four. It distresses approximately 5% to 10% of this age group3. The insulin confrontation and hyperandrogenemia may initiate within the fetal existence and may be sensed within the early life.

The trace minerals has recognized for extensive period as having probable for ornamental metabolic diseases e.g prediabetes (insulin resistance, obesity and metabolic disorder) or diabetes mellitus. Copper is vital to the appropriate operative of tissues and metabolic procedures Copper is indispensable for the normal growth and growth of human fetuses, infants, and children4. Zinc is initiate in cells through the body. It is desirable for the body’s defensive (immune) system to accurately work. It theatres a role in, cell growth, curled therapeutic, cell division, and the breakdown of carbohydrates5. Magnesium is an essential mineral that is crucial for our bones, muscles, heart, brain, immune system and nerve health. Female with magnesium deficiency are at 19 time’s higher risk of PCOS than those with normal magnesium levels.
PCOS patients with insulin resistance can exhibit meaningfully lower serum stages of magnesium, further linking magnesium and PCOS. Insulin and blood sugar balance is critical to reversing PCOS (6).

**Materials and Method**

The current study includes 200 female. Those are divided into two groups: control group & patient group. Patient group included of 100 patients of age variety from 15-45 years, PCOS was identified according to the Rotterdam conditions. The resistor group included of 100 females who are healthy of the same age group with no biochemical or clinical mechanisms of hyperandrogenism, and regular menstrual cycles. The collection of blood samples was done subsequent abstaining of 8 hrs between 2nd or 3rd day of impulsive menstrual cycles. Ultrasound inspection is achieved on the similar day to all female patients.

IR is insulin resistance and is measured by HOMA (homeostasis model assessment). A value of more than 3.8 is considered as resistance (7). Insulin resistance is resolute from consuming inequality below: HOMA-IR: Fasting insulin x Fasting glucose / 405. Copper and Zinc measured by enzymatic methods using a spectrophotometer and magnesium measured by methylthymol blue method by using an autoanalyser. Also fasting blood glucose and insulin were also measured.

**Statistical analysis:**

Descriptive & inferential statistical scrutiny has passed out in the current paper. Outcomes on uninterrupted extents are obtainable on Mean ± SD (Min-Max) and consequences on categorical measurements are obtainable in Number (%). Significance is evaluated at 5% level of implication. Learner t test (two tailed, independent) has been charity to discovery the meaning of study parameters on unceasing scale among two groups (Inter group analysis) on metric parameters. Leven1s test for homogeneity of alteration has been achieved to measure the homogeneity of modification. Chi-square/ Fisher Meticuloustrial has been used to novelty the connotation of study parameters on definite scale among two or N number of groups, Non-parametric setting for Qualitative data analysis. Fisher exact test used when cell samples are very small. Pearson correlation among study variables is achieved to find the degree of relationship. Pearson correlation co-efficient ranging between -1 to 1, -1 being the faultless negative correlation, 0 is the no correlation and 1 means perfect Positive correlation (9,10)

**Results**

Table 1: Distribution of Copper /Zinc /Magnesium in two groups studied

<table>
<thead>
<tr>
<th>variables</th>
<th>Cases (n=99)</th>
<th>Control (n=99)</th>
<th>Total (n=198)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper µg/dl</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;90</td>
<td>28 (28.3%)</td>
<td>38 (38.4%)</td>
<td>66 (33.3%)</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>90-120</td>
<td>23 (23.2%)</td>
<td>39 (39.4%)</td>
<td>62 (31.3%)</td>
<td></td>
</tr>
<tr>
<td>&gt;120</td>
<td>48 (48.5%)</td>
<td>22 (22.2%)</td>
<td>70 (35.4%)</td>
<td></td>
</tr>
<tr>
<td>Zinc µg/dl</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;70</td>
<td>20 (20.2%)</td>
<td>29 (29.3%)</td>
<td>49 (24.7%)</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>70-140</td>
<td>36 (36.4%)</td>
<td>57 (57.6%)</td>
<td>93 (47%)</td>
<td></td>
</tr>
<tr>
<td>&gt;140</td>
<td>43 (43.4%)</td>
<td>13 (13.1%)</td>
<td>56 (28.3%)</td>
<td></td>
</tr>
<tr>
<td>Magnesium mg/dl</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1.6</td>
<td>23 (23.2%)</td>
<td>1 (1%)</td>
<td>24 (12.1%)</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>1.6-2.4</td>
<td>52 (52.5%)</td>
<td>78 (78.8%)</td>
<td>130 (65.7%)</td>
<td></td>
</tr>
<tr>
<td>&gt;2.4</td>
<td>24 (24.2%)</td>
<td>20 (20.2%)</td>
<td>44 (22.2%)</td>
<td></td>
</tr>
</tbody>
</table>
Chi-Square test/Fisher Exact test

Table 2 shows the comparison of copper, zinc, magnesium values among cases and controls. There is a significant variation in all three parameters among both groups.

Comparison of Copper/Zinc/magnesium in two groups were studied.

<table>
<thead>
<tr>
<th>variables</th>
<th>Cases</th>
<th>Control</th>
<th>Total</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper µg/dl</td>
<td>125.00±38.13</td>
<td>101.29±24.96</td>
<td>113.15±34.27</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>Zinc µg/dl</td>
<td>117.02±43.91</td>
<td>93.80±33.93</td>
<td>105.41±40.83</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>Magnesium mg/dl</td>
<td>2.05±0.43</td>
<td>2.06±0.34</td>
<td>2.05±0.38</td>
<td>0.825</td>
</tr>
</tbody>
</table>

P<0.001**, significant, student t test

HOMAIR<2.5

HOMAIR 2.5 – 3.5

HOMAIR>3.5

Table 3 shows the comparison of HOMAIR values among cases and controls. There is a significant variation between both groups.

HOMAIR distribution in two groups were studied.

<table>
<thead>
<tr>
<th>HOMAIR</th>
<th>Cases</th>
<th>Control</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2.5</td>
<td>10 (10%)</td>
<td>20 (20%)</td>
<td>30 (14.6%)</td>
</tr>
<tr>
<td>2.5-3.5</td>
<td>33(33%)</td>
<td>80(80%)</td>
<td>113(57.1%)</td>
</tr>
<tr>
<td>&gt;3.5</td>
<td>57(57%)</td>
<td>0(0%)</td>
<td>57(28.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>100(100%)</td>
<td>100(100%)</td>
<td>200(100%)</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>3.41±0.66</td>
<td>2.83±0.33</td>
<td>3.12±0.60</td>
</tr>
</tbody>
</table>

Table 4 shows there is significant correlation of IR with serum copper, zinc and magnesium.

Correlation of Insulin Resistance and Copper, Zinc, Magnesium by Pearson correlation

<table>
<thead>
<tr>
<th>Pair</th>
<th>Cases r value</th>
<th>Cases P value</th>
<th>Control r value</th>
<th>Control P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOMAIR vs Copper µg/dl</td>
<td>0.622</td>
<td>&lt;0.001**</td>
<td>-0.082</td>
<td>0.423</td>
</tr>
<tr>
<td>HOMAIR vs Zinc µg/dl</td>
<td>0.514</td>
<td>&lt;0.001**</td>
<td>-0.129</td>
<td>0.202</td>
</tr>
<tr>
<td>HOMAIR vs Magnesium mg/dl</td>
<td>-0.453</td>
<td>&lt;0.001**</td>
<td>-0.165</td>
<td>0.103</td>
</tr>
</tbody>
</table>

Discussion

High Copper concentrations can contribute issue of LH and adrenocorticotropic hormone by moving the pituitary gland, which disturbs ovulation. Other study has exposed that copper & zinc might source oxidative anxiety to act on PCOS by upsetting the hormone levels. In the present paper there is an increase in copper and zinc in PCOS female and in patients with insulin resistance.

Several mechanisms have been optional to enlighten the connotationamonginsulin &zinc conflict. Zinc plays a significant part in the steadying of insulin hexamers and the pancreatic storing of insulin since it can improve insulin compulsory to hepatocyte membranes. In circumstance, condensed hepatic insulin binding to hepatocyte membranes through zinc shortage may
be related with the influence of zinc through insulin receptor amalgamation (12). Moreover, Zinc can galvanize the insulin signaling alleyway over inhibition of protein tyrosine phosphatase important to improved phosphorylation of the insulin receptor. Also, Zinc ions can exertion in an insulin mimetic way inside adipocytes, stimulating lipogenesis and glucose transport through translocation of glucose transporter 4 (GLUT4) to the cell membrane (13). Other mechanisms of zinc’s relationship to PCOS may be its effect on oxidative stress; zinc is co-factors of antioxidant enzymes such as catalase and SOD. Hyperinsulinemia and/or hyperglycemia also have the appositive impact on oxidative stress. It is imaginable that, in patients with PCOS, reduced antioxidant ability can be heightened by Zn shortage and IR (14).

However magnesium role in PCOS has always been controversial. Many studies reveal there are normal or decrease levels. In this paper we have detected a momentous decrease in magnesium levels in individuals with Insulin resistance. Similar studies performed in Sudanese female but no significant (15).

Conclution

Serum copper, zinc is higher in patients with PCOS with insulin resistance than healthy controls. Serum magnesium is lower in female with polycystic ovaries with insulin resistance in comparison with control. This study shows a strong correlation of insulin resistance and serum levels of copper, zinc and magnesium.

Ethical Clearance - Not required

Source of Funding - Self

Conflict of Interest - Nil

References

5. Pfeiffer CC, Braverman ER, Zinc, the brain and behavior. Biol Psychiatry 17: 513-532, 1982.
Service Quality and its influence on Customer Satisfaction in a Multi-speciality Hospital

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²Student, Vit Business School, Vit University, Vellore, Tamil Nadu, India

Abstract

Objective: The objectives of this paper is to assess the quality of services offered by multi-speciality hospital suffice patient satisfaction. Also to bring out the various factors that creates patient satisfaction. Further to evaluate the aspects relating to expectation, perception and satisfaction of the services provided by the hospital.

Purpose: The purpose of this paper is to examine service quality in multi-speciality hospital in a town where fast mushrooming of private hospitals are at large in South India, India. Specifically, this study examines the five dimensions of SERVQUAL instrumentation (reliability, assurance, tangibles, empathy, and responsiveness) with respect to customer satisfaction of the services offered by the hospital. A comprehensive service quality measurement scale (SERVQUAL) is empirically evaluated for its potential usefulness in a Multispecialty Hospital.

Findings: The patients showed positive response on the service quality variables and do have high agreement levels of the dimensions of SERVQUAL. Service quality has emerged as the highest expected aspect by the patients at the hospital.

Research limitations: The research scope registered only patients experiences, (respondents) and experiences observed at the time of study.

Practical Implications: The study provides a new understanding of SERVQUAL dimensions in the context of a multi-speciality hospital in a place where these services are provided and offered with a differentiation. Thus provides an understanding of these dimensions and its role in making the organisation stand out among the intense competition and sustain in the long run.

Keywords: Service Quality, Patients, Customer Satisfaction, and multi-speciality hospital.

Introduction

Healthcare is one of the India’s largest sectors - both in terms of revenue and employment. Healthcare includes hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance and medical equipment. The Indian healthcare sector is growing at a brisk pace due to its strengthening coverage, services and increasing expenditure by public as well private players. The private sector provides majority of secondary, tertiary and quaternary care institutions with a major concentration in metros, tier I and tier II cities (June, 2018;www.ibef.org).

Putting the patient first is a challenge that requires not just a more change in the mind-set of all the holders in health care sector, but also means by which to measure the levels of satisfied patients, and discover the various factors leading to that, during and before their visit to any hospital. Patient quality initiatives with their softer, experiential focus, qualified doctors, skilled staff, needs a precautionary scientific measurement techniques in understanding the patient satisfaction aspects and quality levels.

Customers perceive the services in terms of quality service and satisfaction by experience. Service quality
is critical element in shaping customer satisfaction. Services that are offered in the combination of physical product, service quality and satisfaction is also be very critical in responding to customer satisfaction.

**Literature Review**

The ever growing population and increasing standards of living of people have determined significant growth within the global healthcare services sector, as consumers have demanded better medical care to support their standards of living. In the light of the above literature reveals that there is a positive relationship exists between service quality and satisfaction.

Weitzman (1995) suggested that health care quality is defined in relationship to (1) the technical aspects of care, (2) the interpersonal relationship between practitioner and patient, and (3) the amenities of care. Hence the current study tries to understand the role of service quality and the aspects leading to satisfaction of patients visiting the hospital.

Andaleeb (1988) opined that those hospitals that fail to understand the importance of delivering customer satisfaction may be inviting possible extinction. Service quality always received special attention from the service marketers because it was within the control of the service provider and continuous improvement of service quality certainly influenced customer satisfaction and buyer’s intention to purchase the service. Hence delivering quality service is pivotal to drive satisfaction. As production and consumption of the services occur simultaneously, strategies that acknowledge the importance of the consumer must always be integrated into the hospital healthcare delivery system process (Craig et al., 2007).

The base for the SERVQUAL scale is the gap model proposed by Parasuraman, Zeithaml and Berry (1985, 1988). Service quality is not a monolithic concept and leans on several dimensions with varied importance to overall service quality, and their impact on patient’s satisfaction (Saunders, 2008).

Rohini and Mahadevappa (2006) applied SERVQUAL framework and SERVQUAL factors in their study on Bangalore (India) hospitals. The study concluded with the existence of an overall gap between patient’s perceptions and expectations and also between the management’s perception of patients’ expectations and patient’s expectations.

Pakdil and Harwood (2005) considered patient satisfaction in a pre-operative assessment clinic and the outcome of the study showed that patients were most dissatisfied with the waiting time and recommended the hospitals should provide prompt services and provide waiting rooms or halls with news dailies, magazines and television sets to make patients more comfortable during their wait. Finally positive physician patient satisfaction increased patient satisfaction more than any other provider of customer relationship.

Managers and professionals contend that patients perception of quality in health care is not accurate, because of the inability of patients to analyse and judge the technical competence of the medical practitioners with accuracy and it would be highly appreciable to impart soft skill training to enable them to get close to their patients and create the closeness of the treatment rendered to patients (RaduanChe Rose JegakUliMohani Abdul and Kim Looi Ng, 2004).

Managing service processes has a very special importance in service industry as it offers a process for delivering services and patient satisfaction with the quality of care rendered. Effective service offering creates unique customer experiences, which would make the consumers use the services repeatedly (AR Bamidele, ME Hoque& H Van der Heever, 2011).

Interaction of hospital staff with the customers visiting the service setting effects the perceptions of service quality and hospitals need to ensure that the front end and back end processes are aligned in a sequence that demonstrates positive moments of truth in service quality dimensions followed and thereby impacting the satisfaction of patients(Victor Lorina, Iuliana Raluca Gheorghea, and Petrescuba, 2013).

Consumer satisfaction is consumer’s response to the evaluation of the perceived inconsistency between prior expectations and the actual performance of the product or service after consumption (Tse and Peter, 1988). Consumer’s satisfaction acts as a guide for monitoring and improving the current and potential performance of any business (Zairi, 2000).

We strongly believe that patient satisfaction have to find its way in designing of services in an industry where services are dominant. Because of the relationship
between perceived service quality and satisfaction (Taylor & Cronin, 1994; McAlexander, Kaldenberg & Koenig, 1994) this study addresses two major research objectives:

**Service Design Of Hospital**
Methodology

Research Description

<table>
<thead>
<tr>
<th>Research type</th>
<th>Descriptive Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample size</td>
<td>485</td>
</tr>
<tr>
<td>Sampling type</td>
<td>Non-probability convenience sampling</td>
</tr>
<tr>
<td>Data collection techniques</td>
<td>Structured questionnaire survey</td>
</tr>
<tr>
<td>Data Interpretation tools</td>
<td>Microsoft Excel and SPSS 21.0</td>
</tr>
</tbody>
</table>

Sampling method

The study collected data from 515 samples and 30 samples were disregarded due to incomplete data. Structured questionnaire survey was used to collect data from the respondents Non-probability convenience sampling method was deployed to collect from respondents who visited the hospital. Data was collected inpatients and from the accompanied persons who came along with the patients.

Statistical analysis: Microsoft Excel and SPSS 21.0 were used for analysis and interpretation. Descriptive statistics, correlation and regression analysis was conducted and the results were discussed.

Descriptive Statistics

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>215</td>
<td>44.3</td>
<td>44.3</td>
<td>44.3</td>
</tr>
<tr>
<td>Female</td>
<td>270</td>
<td>55.7</td>
<td>55.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>485</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The descriptive statistics indicates the percentage/share of male and female contributed to the survey. In which Male indicate Percentage i.e. 44.3% (215 out of 485) and Female indicate percentage i.e. 55.7% (270 out of 485).
Correlation Analysis

Correlation

Correlation analysis was used to find the relationship between the SERVQUAL variables. The results revealed that all the relationship were positive with the significance level of 0.000 which is less than the required 0.05 (Hair et al., 2016). The strongest relationship and the weakest were tabulated

Regression Analysis

The regression analysis is carried on independent variables i.e. tangibility, reliability, responsiveness, assurance, courtesy and empathy on dependent variable being customer satisfaction. The significant value is to less than 0.05 to be qualified/ accepted for every variable and hence there would a positive influence on independent variables.

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model B</td>
<td>B</td>
<td>Beta</td>
</tr>
<tr>
<td></td>
<td>Std. Error</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant) 3.535 .193</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TANGIBILITY -.048 .087</td>
<td>-.048 -.554 .580</td>
</tr>
<tr>
<td></td>
<td>RELIABILITY .025 .080</td>
<td>.027 .309 .758</td>
</tr>
<tr>
<td></td>
<td>RESPONSIVENESS .095 .090</td>
<td>.101 1.056 .029</td>
</tr>
<tr>
<td></td>
<td>ASSURANCE .116 .077</td>
<td>.125 1.518 .030</td>
</tr>
<tr>
<td></td>
<td>COURTESY -.104 .080</td>
<td>-.117 -1.306 .192</td>
</tr>
<tr>
<td></td>
<td>EMPATHY .038 .065 .044</td>
<td>.589 .556</td>
</tr>
</tbody>
</table>

The relationship between reliability and tangibility has a strong positive correlation with correlation value of 0.815. This is the strongest relationship among the variables tested. The relationship with lowest value was between empathy and tangibility which is 0.613. The relationship is strongly correlated.

The regression analysis shows that responsiveness and assurance has an impact on satisfaction of the customer. All the other independent variables don’t show any impact on the dependent variable. Assurance has the strongest influence than responsiveness on satisfaction.

Discussions

The study had more of female respondents with 270 being female and 215 out of the 485 are male. The respondents have stressed the importance of high expectations of each and every criterion of SERVQUAL dimensions. All the correlation relationship texted between the all variables of service quality has positive relationship with each other. The correlation relationship among tangibility, reliability, assurance, responsiveness and empathy dimensions is highly positive.

Limitations

The sample was selected from only one health care facility. Individual’s response was declined if the patient didn’t patronage in the hospital. The study suffers from response error as earlier studies. It must be noted that despite our meticulous care the survey have response bias. Language barrier was present which the researchers
worked to overcome. The study needs to be extended to be generalized in other health care sectors. It is possible for the study to be generalized if the study is conducted in few more hospitals across geographical area.

Suggestions

The main aim of hospital is to cure, care, access component and the physical environment. It is important that the hospitals concentrate on the responsiveness and assurances component of services quality. Assurance in a hospital environment should be the utmost concentration. Assurance of good service and care in an environment of life and death goes long way in promoting the hospital. Responsiveness will make the customers feel safe and secure thus promoting high reputation. It is the management and all the stake holders’ duty to provide assurance and instil a feeling of responsiveness from their part. All the component of SERVQUAL must be concentrated to provide world class service. Our study also suggests that the waiting time needs to be decreased in order for the patients to feel satisfied. E-services need to be given an easy user interface. Parking should be well maintained. Physical queue in hospital needs to be short. But at the end of the day quality plays the major role in hospital sector for satisfying the customers.

Conclusion

In the current research, all the service quality dimensions such as tangibility, reliability, responsiveness, assurance, courtesy and empathy are important in creating customer satisfaction in a multi speciality hospital. Other than responsiveness and assurance, no other variables have any significant association with customer satisfaction. The other variables like tangibility, reliability, courtesy and empathy need to be given special attention.

Therefore it’s in the hands of the hospital staff to create and ensure responsiveness and assurance for the patience among themselves. They need to take the response for the actions of the hospital and strive to improve it. All the treatment related details needs to be disclosed to the patients and relatives. It creates an environment where the staffs take responsiveness for patients. So, patients feel trusted with the products and services offered in this hospital.

Staff must be trained to answer all the questions and induce trust on them and the hospitals. Hospital Staff ought to be considerate amidst confirmations technique and to be well mannered amidst housekeeping process. Staffs need to be eager in helping the patients and their relative. They must develop a rapport and exude positive personality.

Ethical Clearance - Not required

Source of Funding - Self

Conflict of Interest - Nil

References


Comparison of Hip Flexor Strength According to Pelvic Tilting Angle

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Abstract

Background/Objectives: The purpose of this study is to observe effects of pelvic positions such as neutral, pelvic anterior tilting and pelvic posterior tilting position on strength of hip flexor.

Methods/Statistical analysis: This study included 30 normal adults, comprising 15 males and 15 females who have no operations or orthopedic, neurological diseases. Subjects performed 5 seconds of isometric hip flexion in each position for 3 times. One-way ANOVA was used to analyze the difference of individual data and Bonferroni correction was used for the Post-hoc.

Findings: There was a significant difference when comparing neutral position and anterior tilting position.

Improvements/Applications: In conclusion, the result shows that the muscle length changes according to the pelvic tilting angle and it effects to muscle strength.

Keywords: Pelvic tilting, Length-tension relationship, Pelvic cross syndrome, Hip flexor, Active straight leg raise

Introduction

Recently, abdominal obesity due to lack of exercise was increasing. Abdominal obesity referred to the accumulation of excess fat in the abdomen. According to the criteria announced by the Korean Society for the Study of Obesity, abdominal obesity was reported when the waist circumference at the upper part of the navel exceeded 90 cm (36 inches) for men and 85 cm (34 inches) for women¹. Abdominal obesity led to an increase in the anterior tilting angle of the pelvic, which in turn increased the lordosis⁴. Pelvic crossed syndrome was caused by imbalance of muscle to maintain pelvic neutrality⁵,⁶. To maintain the neutral of the pelvic, the length of the muscles associated with the pelvic tilting should be known for optimal muscle strength around the pelvic. This problem caused low back pain. The low back pain reduced strength, endurance, mobility and coordination, thereby limiting daily life and reducing quality of life⁸,¹². The pelvic anatomy was formed by a pair of left and right innominate bone and one sacrum and coccyx, respectively. Hip joints were ball and socket joints formed by the acetabulum and femur head of the hips, and complex movements were possible. Several ligaments and muscles that provided stability to support the body were distributed around the articular capsule. The pelvic tilting was the angle between the anterior superior iliac spine (ASIS), the posterior superior iliac spine (PSIS), and the line formed by the horizontal line. The average pelvic tilt angle was 11 ± 4 ⁰. Previous studies have investigated the relationship between spinal trauma, abdominal muscles, and pelvic tilt. The muscles of the abdomen contributed to the posterior tilt of the pelvic and the posterior tilt of the pelvic reduced lordotic curve of the lumbar⁵. Therefore, knowing the most effective muscle length for the strength of the abdominal muscles to find the neutral of the pelvic was important for rehabilitation.

Active straight leg raise (ASLR) exercise reported to play an important role in the prevention and treatment of back pain¹⁵, and to be effective in maintaining the neutral posture of the pelvic⁶. It showed to be effective in increasing the thickness of the transverse abdominal
muscle and multifidus and was effective in reducing back pain and disability\textsuperscript{16}. During ASLR exercise, the length of the involved muscles depends on the pelvic tilting. As muscle length changes, actin and myosin are superimposed on each muscle, and muscle fiber segment length decreases or increases. The physical effect of this was to reduce or increase tension\textsuperscript{17}. This change followed a length-tension curve. The muscle length was reported to be mainly due to the overlap between thin actin filaments and thick myosin filaments\textsuperscript{18}. According to the length-tension curve of the normal muscles, the greatest muscle strength was exhibited when actin and myosin, which represent the length of the sarcomere, were most appropriately overlapped. There was almost no tension when fully contracted, and the tension when fully extended was also significantly smaller than the maximum\textsuperscript{19}.

There were many studies on how to do ASLR exercises and to give more effect by giving various variations. In previous studies, ASLR exercise was performed on subjects with quadriceps weakness. One group performed ASLR with dorsiflexion of the ankle and external rotation of the hip joint. Another group performed ASLR with external rotation of hip joint. In both groups, the muscle activity of the vastus medialis and vastus lateralis was compared. Both muscles showed more muscle activation when the dorsiflexion of the ankle and the external rotation of the hip joint were combined. As a result, when ASLR was performed to strengthen the quadriceps muscle strength, a greater effect was obtained when the dorsiflexion of the ankle and the external rotation of the hip joint were combined.

There have been many studies to compare muscle strength by varying the angle of the joint and changing the length of the muscle according to the length-tension curve. However, studies comparing the length and strength of the hip flexor by adjusting the pelvic tilting angle were insufficient. The purpose of this study was to determine the muscle strength of ASLR by comparing the pelvic tilting angle and the muscle strength of ASLR.

**Materials and Method**

**Participants**

This study was conducted on healthy young adults (male 15, female 15). The physical characteristics of subjects were as follows [Table 1]. Those with vertebra diseases, those with joint diseases, and those with previous joint disease or surgery were excluded from the study. All subjects understood the procedure and purpose of this study. This study was conducted according to the protocol approved by the Institutional Review Board of Sun Moon University.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Subjects (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(year)</td>
<td>21.17±1.49</td>
</tr>
<tr>
<td>Height(cm)</td>
<td>167.33±10.05</td>
</tr>
<tr>
<td>Weight(kg)</td>
<td>65.87±17.43</td>
</tr>
<tr>
<td>Pelvic anterior tilting(degree)</td>
<td>10.91±5.06</td>
</tr>
<tr>
<td>Pelvic posterior tilting(degree)</td>
<td>-6.11±3.33</td>
</tr>
</tbody>
</table>

**Procedure**

This study was conducted as a single group and as an experimental group without a control group. Prior to participating in the experiment, subjects were trained on anterior tilting and posterior tilting of the pelvic in each posture (standing, sitting and supine) to perform the correct posture of the pelvic. The maximum tilting angle of the pelvic of the subject was measured when the subject voluntarily formed the maximum anterior tilting and maximal posterior tilting. Micro Electro-Mechanical Systems (MEMS) sensors were attached to the ASIS to measure the pelvic angle. After measuring the maximum tilting angle of the pelvic of each subject, a stabilizer and a towel were used to form the anterior and posterior tilting of the pelvic of the subject. The anterior tilting of the pelvic was formed by supporting PSIS and the posterior tilting was formed by supporting coccyx.

The subject lay in a supine position. The hip flexion was performed with the trunk fixed using a belt. The hip flexor strength was measured in three postures such as neutral, pelvic anterior tilting and pelvic posterior tilting position using Isokinetic Muscular Joint evaluation and Rehabilitation Exercise System (CSML Humax Co. USA 2001) [Figure 1]. The isometric contraction force was measured three times for 5 seconds at an angle of 30° of flexion of the hip joint, and the average muscle strength was recorded.
Materials

The isometric strength of the hip flexor was measured using an isokinetic dynamometer. All subjects were measured after wearing shorts and three times isometric contraction was performed for 5 seconds at 30 degrees of hip flexion. There was a twenty minutes break between each measurement. The pelvic tilting angle was measured by using a MEMS sensor capable of measuring the angle of the joint using a three-dimensional axis. The sensor was horizontally attached to the ASIS and the pitch value indicating the flexion-extension value was recorded in Roll (z axis), Yaw (y axis) and Pitch (x axis)\(^20\).

Statistical Analysis

All measured values were analyzed using SPSS / PC ver.17.0 for Windows program (SPSS Inc., Chicago, USA) for the analysis of the study data. One-way ANOVA was used to compare the isometric strengths for each group, and Bonferroni was used for post-test. All statistical significance levels were set at \(p < 0.05\).

Results and Discussion

Muscle strength was measured during ASLR exercise in three postures according to the position of the pelvic, and significance level was analyzed using one-way ANOVA [Table 2, 3]. There was a significant difference between neutral and pelvic anterior tilting (\(p < 0.05\)). However, there was no significant difference between the pelvic anterior tilting and the pelvic posterior tilting, the neutral and the pelvic posterior tilting (\(p > 0.05\)). The mean value of neutral was 65.43 ± 25.69, 48.30 ± 22.87 in the pelvic anterior tilting, and 58.90 ± 22.67 in the pelvic posterior tilting. The mean value of muscle strength in the neutral position was the highest, and the muscle strength in the pelvic anterior tilting was the lowest.

Table 2. The muscle strength of the hip flexor according to pelvic tilting (N/m)

<table>
<thead>
<tr>
<th></th>
<th>Neutral</th>
<th>Anterior tilting</th>
<th>Posterior tilting</th>
<th>(F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength of the hip flexor</td>
<td>65.43 ± 25.69</td>
<td>48.30 ± 22.87</td>
<td>58.90 ± 22.67</td>
<td>3.965*</td>
</tr>
</tbody>
</table>

\(p<0.05\), mean ± standard deviation

Table 3. The comparison of the strength of the hip flexor according to pelvic tilting

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Difference in average value (A-B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>Anterior tilting</td>
<td>17.13*</td>
</tr>
<tr>
<td></td>
<td>Posterior tilting</td>
<td>6.53</td>
</tr>
<tr>
<td>Anterior tilting</td>
<td>Posterior tilting</td>
<td>-10.60</td>
</tr>
</tbody>
</table>

\(p<0.05\)

The purpose of this study was to investigate the effect of the neutral of the pelvic, pelvic anterior tilting and pelvic posterior tilting on muscle strength at hip flexion. Therefore, the muscle strength of the hip flexor according to the tilting of the pelvic was compared. As a result, there was a significant difference in the muscle strength between the neutral and the anterior tilting of pelvic. Giuseppe et al. (2016) investigated the proper sarcomere length of quadriceps and hamstring after performing a concentric resistance exercise with different muscle...
lengths at different angles. The resistance exercise was performed at 20°, 30°, 40°, 50°, 60°, 70° and 80° angles of the knee extension, respectively. The quadriceps were most effective at 70° and the hamstring at 20° to 50° was the most effective resistance exercise with the optimal sarcomere length. Williams et al. (1977) reported that the longer and shorter muscle lengths vary depending on the overlap length of actin and myosin. When high energy myosin bonded to actin, it used energy stored in myosin to move myosin head. In a previous study, there was a comparison of the relationship between cross bridge and muscle strength. According to Rassier et al. (1999), when the skeletal muscle generated a force, the actin filaments and myosin filaments were overlapped to form a cross bridge, and the muscle force was changed according to the change of the length of the sarcomere. The relationship between the length of overlapping sarcomere of two filaments (1.27 μm to 4.24 μm) and muscle strength was analyzed. The shorter the length of the sarcomere, the stronger the force. However, when the length of the sarcomere was 2.81 μm, the greatest strength occurred. Therefore, it was reported that the muscle was able to exert the greatest force when superimposed at the optimal length. In other words, it was confirmed that the superposition formed from the neutral of the pelvic rather than the pelvic anterior tilting generated the greatest strength through the length of the appropriate sarcomere. As in previous studies, the results of this study showed the greatest muscle strength in the neutral of the pelvis, where overlap muscle was most optimal.

Muscle strength was one of the important factors for health. It was also reported that muscle strength was applied indirectly as a measure of the ability to perform functions and the degree of health. According to Miyake et al. (2001), muscle strength of various types of trunk muscles played an important role in the prevention and treatment of the low back pain. In addition, Hayden et al. (2005) reported that trunk strength exercise was effective in reducing low back pain. In this study, muscle strength was measured. Recently, the strength of the hip flexor, which contributed to abdominal strength, measured due to the increasing tendency of abdominal obesity in modern people. Neumann et al. (2010) reported that rectus femoris, rectus abdominis, and psoas muscle were activated when ASLR exercise was performed. The main muscle of the hip flexion was psoas major, and in this study, the muscle strength of the hip flexor was measured during ASLR with varying muscle length of psoas major. Lobstein et al. (2004) reported that obesity caused a change in posture due to a change in pelvic tilt angle, resulting in imbalance caused by weak and long muscles and shortened muscles. According to Hogan et al. (1985), the length of the muscles varied according to posture and played an important role in the performance of strength and exercise. Dreyfuss et al. (1994) reported that when the pelvic anterior tilting was abnormally increased, the muscle length of the rectus abdominis, internal oblique abdominal muscle, external oblique abdominal muscle, and gluteus maximus muscle increased. According to the theory of length-tension curve, muscles exhibit the greatest muscle strength when the length of the sarcomere superimposed by actin and myosin is the most appropriate overlap. However, in the excessive pelvic anterior tilting, the superposition of actin and myosin in the muscles that flexion the hip joint was not appropriate, resulting in muscle weakness. In addition, office workers or students were more likely to experience kyphosis due to sitting postures. As a result, excessive pelvic posterior tilting occurs. Finally, erector spinae, quadratus lumborum, rectus femoris, and iliopsoas are relaxed, resulting in muscle weakness and pelvic crossed syndrome. In other words, the role of the pelvic was most important in maintaining proper posture. The pelvis should be in a neutral position in the standing posture and care should be taken when adjusting the posture. In particular, it was important to adjust the tilt angle of the pelvis in exercising the hip joint.

This study had some limitations. First, since the age range of the subject was limited, it was difficult to generalize to all ages, and most of the modern people had a little abdominal obesity, so the neutrality of the pelvic was not complete. Second, the maximum pelvic tilting angle was not accurately measured because the MEMS sensor continuously changes the value even with the fine movement of the subject. Third, in this study, pelvic tilting angle was controlled with a stabilizer and a towel. There was a possibility that the angle might have changed due to the pressure of the towel when performing the exercise.

Conclusion

The purpose of this study was to investigate muscle strength according to muscle length by comparing the
isometric strength of the hip flexor according to the pelvic tilting angle. According to the results of the study, there was a significant difference between the neutral of the pelvic and the anterior pelvic tilting, and the strength of the hip flexor was measured the greatest in the neutral position. In other words, it was found that the muscle length changes according to the pelvic tilting angle and the muscle length change also affects the muscle strength. For an effective hip flexion exercise, it is important to perform in the neutral position of the pelvic. It was the most important to maintain the neutral position of the pelvis in order to perform an effective hip joint flexion exercise. Therefore, patients with pelvic crossed syndrome due to obesity and postural changes should be exercising for neutral position of the pelvis before exercise.

**Ethical Clearance:** Taken from the Institutional Review Board of Sunmoon University

**Source of Funding:** Self

**Conflict of Interest:** Nil

**References**


The Effects of College Students’ Stress on Drinking, Smoking, and Health Promoting behaviors

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Abstract

Background/Objectives: The purpose of this study was to identify the effects of college students’ stress on drinking, smoking, and health promotion behaviors and to provide basic data for health promotion of university students.

Methods/Statistical analysis: This study is a descriptive correlation study. The data were collected via structural questionnaires completed by 132 college students located in S, C and G province who agreed to participate in this study. It is a proper sample size with a significance level (α) of 0.05, a power (1-β) of 0.95, and a medium effect size (f) of 1.5 according to the G*power 3.1.9.2 program

Findings: There were statistically significant correlations between stress and the following factors: drinking ($r=0.946$, $p<0.001$), smoking ($r=0.227$, $p=0.009$), health promoting behavior ($r=-0.238$, $p=0.006$). Multiple regression analysis revealed that the following factors exert a significant influence on stress of college students: drinking ($B=1.099$, $p<0.01$), smoking ($B=1.81$, $p<0.08$) and health promoting behaviors ($B=-0.090$, $p<0.006$).

Improvements/Applications: Educational authorities need to know increasing stress for college students in relation to their drinking, smoking and health promoting behaviors and to support that.

Keywords: College students, stress, drinking, health promotion

Introduction

College students are not only transitioning from adolescence to adulthood but also experiencing various stresses such as heterosexuality, economic problems, future problems, and academic problems. As one of the measures to cope with the stress of college students, they choose to drink and smoke, and they affect the health promoting behavior, so health problems can be attributed to individual health, academic, interpersonal and physical and mental illnesses. Therefore, socioeconomic costs resulting from suspension or criminal activity are generated, thereby increasing medical expenses and social burdens. It is also the period when drug abuse and other dangerous behaviors increase. In this way, the stress of college students is becoming more important as they threaten many socio-economic problems and individual health and future. When alcohol acts positively according to the individual, it provides the pleasure of the relationship and the relationship between the members, but when it acts negatively, it can be one of the causes of various social problems, resulting in serious damage to the individual’s physical, mental, social and professional functions. Drinking of college students is also triggered by activities for friendship in various college life, relatively easy to overdrink, resulting in constant incidence of alcoholic accidents due to excessive drinking culture on campus. Drinking is forced after almost every event in college life, and it is spreading to social problems such as alcohol accidents, and the seriousness of the problem is rising. In particular, more than half of Korean college students experienced binge drinking, while the university students’ binge drinking ratio was 73.1% for male students and 56.0% for female students, but there was no difference in the rate of experiencing drinking problems after drinking.
It is important to understand how alcohol drinking is affected by college students and how they are affected by excessive drinking behavior, which can have a negative impact on health and academic performance.

Smoking causes cardiovascular and cerebrovascular diseases and increases mortality, but is known to be the main cause of preventable death, also smoking is also a major risk factor for cancer worldwide, accounting for approximately 22% of cancer deaths each year. The Tobacco Control Policy Forum of the WHO Framework Convention on Tobacco Control has estimated that the number of deaths from the global tobacco-related diseases worldwide is about 6 million, unless appropriate action is taken, the number of deaths due to smoking-related illnesses in the 21st century is expected to increase to over 1 billion people.

The college student period is the transition from adolescence to adulthood in physical, mental, and societal, and is a time when physical growth and intellectual development are at their best and a framework of lifelong health is established. Thus, problems that can pose health risks can have a significant impact on the health of your life. However, college students tend to forget or neglect the importance of health and are often independent from their parents and family, and are likely to have unhealthy lifestyles such as smoking due to various psychological, social, and mental stresses such as work and schooling. In addition, the younger adults are less aware of smoking cessation because they are less afraid or anxious about health and have easier access to tobacco and smoking environments, smoking among college students is less affected by family members than smoking among high school students, suggesting the necessity of health promotion activities of smoking students. Health promotion behavior refers to self-leading multidimensional behavior patterns that maintain and enhance individual's level of well-being, self-fulfillment, and satisfaction, it is a dimension to form and maintain healthy lifestyle and prevent health care. Health problems that cause death, illness, and disability in humans can reduced by minimizing health hazards such as smoking and drinking, or by promoting health promoting behaviors such as dietary control. In Korea, however, college students in the early adulthood think that they are liberated from the repressed high school learning environment, accept lazy and harmful environments, and have confidence in their health, and it is important to note that this fact is known to have insensitivity to health care due to the characteristics of adolescents that do not cause any health-threatening symptoms, and that they do little to promote health promotion. Therefore, the necessity of active intervention for health promotion of college students raised. The purpose of this study was to identify the effect of stress on college students’ stress, drinking, smoking, and health promotion behaviors, to understand the severity of the stress of college students and to identify factors related to stress.

The purpose of this study is to investigate the effect of stress of college students on drinking, smoking, and health promoting behaviors. The specific objectives for this are as follows.

Understand the stress, drinking, smoking, and health promotion of college students. Analyze the correlation between college students’ stress, drinking, smoking, and health promotion. Identify the effects of college students’ stress on drinking, smoking, and health promotion.

**Method**

**Ethical-consideration**

The data was collected via structural questionnaires completed by 132 students studying at N university who agreed to participate in this study. All data used was collected according to the approved guidelines and screening procedures of “N University” located in Cheonan. All experiments of the present study were also approved by the Institutional Review Board [IRB No: NSUIRB-201804-008] at “N” University

**Research tools**

**Stress scale:** The Korean version of the A Global Assessment of Recent Stress Scale (GARS) was used to assess the degree of stress. This scale consists of 27 items on the evaluation of daily stress, perceived stress, perception of daily life, change of daily life, workplace, interpersonal relationship, illness and injury, economic problem, The higher the score, the higher the stress. In this study, Cronbach’s α = 0.88.

**Alcohol Use Disorder Identification Testing:** Drinking was measured by Shin (1988), 20-item questionnaire for drinking related problems. The scale consists of 3 domains: Social Impairment Behavior Problem, Family and Interpersonal Impairment, and each
item measures from 0 to 4 points. High scores indicate more problems with drinking behavior. Reliability at that time of tool development was Cronbach’s $\alpha = .94$ and Cronbach’s $\alpha = .76$ in this study.

**Smoking:** In this study, the nicotine dependence assessment developed by Fagerstrom was used. A total of 6 items consisted of 10 points. The higher scores indicating higher levels of nicotine dependence.

**Health promoting behavior:** Health promotion behavior is self-directed multi-dimensional behavior pattern that maintains and strengthens the individual’s level of well-being, self-fulfillment, and satisfaction (Walker, Sechrisy, & Pender, 1987).

In order to approve the use of the tools of Health Promotion Lifestyle-II by Walker & Hill-Polerecky (1996), the original developer was approved to use the tool via email (personal communication, 2008). Cronbach’s $\alpha = .94$ at the time of tool development and Cronbach’s $\alpha = .88$ in this study.

Selection of research subjects, data collection and analysis

The subjects of this study were college students who were enrolled in Seoul, Kyunggi and Chungcheong provinces. The college students who were agreed to participate in the research were selected from convenience sampling method. From July 4 to August 19, 2017, data were collected for 7 weeks. Of the 150 collected data, 132 were used for the statistical analysis except for the insufficient data. The collected data were analyzed through basic statistics (frequency and percentage, mean and standard deviation), Pearson’s correlation coefficient, and multiple regression.

**Result and Discussion**

Descriptive analysis. The general characteristics of the participants are shown in Table 1. The mean age of the subjects was $21.83 \pm 2.16$ years. The study participants included 74 males (55.4%) and 59 females (44.6%). The students’ majors were as follows: 37 humanities and social science (28.0%), 20 natural science (15.2%), 65 health and medical science (49.2%) and 10 students are in the art (7.6%). By grade, 19.6% of first grade students, 26.6% of second grade students, 25.8% of third grade students, and 28.0% of fourth grade students. Religion was 34.8% in Christianity, 8.3% in Catholicism, 8.3% in Buddhism, 8.3% and no religion, 48.5%, respectively.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>n(%) or M±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td>21.83±2.16</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>73(55.4)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>59(44.6)</td>
</tr>
<tr>
<td>Religion</td>
<td>Protestant</td>
<td>46(34.8)</td>
</tr>
<tr>
<td></td>
<td>Catholic</td>
<td>11(8.3)</td>
</tr>
<tr>
<td></td>
<td>Buddhism</td>
<td>11(8.3)</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>64(48.5)</td>
</tr>
<tr>
<td>Type of residence</td>
<td>Home with parents</td>
<td>61(46.2)</td>
</tr>
<tr>
<td></td>
<td>Lodging</td>
<td>43(32.6)</td>
</tr>
<tr>
<td></td>
<td>Dormitory</td>
<td>27(20.4)</td>
</tr>
<tr>
<td></td>
<td>Etc</td>
<td>1(0.8)</td>
</tr>
<tr>
<td>Income of family per month (10,000 won)</td>
<td>200 &lt;</td>
<td>9(6.8)</td>
</tr>
<tr>
<td></td>
<td>200~399</td>
<td>43(32.6)</td>
</tr>
<tr>
<td></td>
<td>400~599</td>
<td>46(34.8)</td>
</tr>
<tr>
<td></td>
<td>≥600</td>
<td>34(25.8)</td>
</tr>
<tr>
<td>Spending money per month (10,000 won)</td>
<td>10 &lt;</td>
<td>8(6.1)</td>
</tr>
<tr>
<td></td>
<td>11~29</td>
<td>26(19.7)</td>
</tr>
<tr>
<td></td>
<td>30~49</td>
<td>51(38.6)</td>
</tr>
<tr>
<td></td>
<td>≥50</td>
<td>47(35.6)</td>
</tr>
</tbody>
</table>

**Stress, drinking, smoking and health promoting behaviors.**

The mean and standard deviation of each variable are as follows. Stress: $32.58 \pm 13.93$ points, drinking: $55.79 \pm 14.00$, smoking: $1.19 \pm 2.34$, and health promotion behaviors: $122.17 \pm 19.85$.

Table 2 shows the results of the subjects’ stress, drinking, smoking, and health promotion behaviors. The mean and standard deviation of each variable are as follows. Stress: $32.58 \pm 13.93$ points, drinking: $55.79 \pm 14.00$, smoking: $1.19 \pm 2.34$, and health promotion behaviors: $122.17 \pm 19.85$. 
Table 2. Descriptive of Stress, Drinking, Smoking and Health promoting behaviors (N=132)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Possible range</th>
<th>Obtained range</th>
<th>M±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress</td>
<td>0-72</td>
<td>5-61</td>
<td>32.58 ± 13.93</td>
</tr>
<tr>
<td>Drinking</td>
<td>0-80</td>
<td>1-67</td>
<td>55.79 ± 14.00</td>
</tr>
<tr>
<td>Smoking</td>
<td>0-8</td>
<td>0-8</td>
<td>1.19 ± 2.34</td>
</tr>
<tr>
<td>Health promoting behaviors</td>
<td>47-188</td>
<td>85-188</td>
<td>122.17 ± 19.85</td>
</tr>
</tbody>
</table>

Table 3 shows the results of Pearson’s correlation coefficients to confirm the correlation between stress, drinking, smoking, and health promoting behaviors. There was statistically significant negative correlation between stress and health promotion (r = -.238, p = .006), between drinking and health promoting behaviors (r=-.358, p=.002). On the other hand, there was a statistically significant positive correlation between drinking and smoking (r=.464, p<.001).

Table 3. Correlations among Health promotion, Drinking and Smoking for Stress (N=132)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Stress</th>
<th>Drinking</th>
<th>Smoking</th>
<th>Health promoting behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress</td>
<td>1</td>
<td>.946(.&lt;.001)</td>
<td>.227(.009)</td>
<td>-.238(.006)</td>
</tr>
<tr>
<td>Drinking</td>
<td>1</td>
<td>.464(.&lt;.001)</td>
<td>- .358(.002)</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>1</td>
<td>- .456(.&lt;.001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health promoting behaviors</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4 summarizes the results of multiple regression analysis to examine the effects of stress on college students drinking, smoking, and health promoting behaviors. The higher the drinking behavior (β= .376, p= .001), the more smoking (β= .233, p= .008), the less health improvement activity (β=-.278, p= .006), it was found that stress increased.

Table 4. Multiple regression of stress, drinking, smoking and health promotion (N=132)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Stress</th>
<th>Standard error</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>48.854</td>
<td>12.030</td>
<td></td>
<td>4.061</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking</td>
<td>1.099</td>
<td>.112</td>
<td>.376</td>
<td>2.882</td>
<td>.001</td>
<td>984</td>
<td>1.016</td>
</tr>
<tr>
<td>Smoking</td>
<td>1.812</td>
<td>.669</td>
<td>.233</td>
<td>2.710</td>
<td>.008</td>
<td>987</td>
<td>1.014</td>
</tr>
<tr>
<td>Health promoting behaviors</td>
<td>.090</td>
<td>.079</td>
<td>-.278</td>
<td>2.135</td>
<td>.006</td>
<td>990</td>
<td>1.010</td>
</tr>
</tbody>
</table>

The study attempted to identify the relationship between stress, drinking, smoking and health promoting behaviors for college students and to identify the effects of stress on drinking, smoking and health promotion. I would like to discuss these results. First, the stress of college students who were the subjects of this study was found to have a mean score of 32.58 points on overall score 72 points. In a study by Ha using the same stress
scale [22] the stress of the subjects was 28.54, which was lower than the stress average score of the study participants, 32.58. The reasons are thought to be: In this study, fourth graders made up the largest number, and in Ha’s study [22], first graders made up the largest number. The 4th grade in university life is more burdensome to get a job than other grades and is a time to think seriously about the future. In the present study, drinking totaled 80 points and the drinking average of the subjects was 55.79, which was relatively high. In Ha’s study using the same tools, mean expression was somewhat different, but it ranged from minimum 1 point to maximum 46 points. In the present study, at least one point was maximum 67 points, the maximum drinking score of the subjects was high. The reason for the above results is that the fourth grade students in this study had the highest number of students, and the correlation between stress and alcohol was positively correlated (r = .946, p < .001) so it seems to be high.

In addition, the subjects of this study were male students’ more than female students, and Shin’s study of male college students showed an average drinking score was 4.84. In Ha’s study of 75.8% of female students, the mean drinking score was 14.62. As a result, it can be guessed that male students drink more than female students. The Jung’s study 24 on the relationship between stress and drinking problems showed that stress had a significant effect on the drinking problem (p = .007), similar to this study, studies of factors affecting female college students’ drinking showed no significant correlation between stress and alcohol, which was different from the results of this study. This may be because women’s college students’ drinking behavior is more likely to be driven by social motives such as private gatherings and maintaining personal relationships than by stress.

Stress can also be an important factor in the onset, continuation and recurrence of alcohol dependence. Based on these findings, I suggest comparative studies of drinking problems between male and female university students. In the present study, there was a significant positive correlation between stress and smoking (r = .464, p < .001). As a result, smoking was a significant variable affecting stress. This was similar to this study in Ryu, & Baek 25 where women’s drinking behavior showed stress as a significant variable that explains female college students’ drinking. Also, in the study of Kim and Lee 26, there is a significant amount of correlation between smoking and job stress (r = .199, p = .001) was similar to the results of this study.

In this study, stress and health promoting behaviors showed a significant negative correlation (r = -.238, p = .006), the lower the health promoting behavior (β = -.278, p = .006), the stress was the higher. In Kim’s study 27 life stress reported, those college students’ school life adaptation and health promoting behaviors are negatively affected. Park and Kim’s study 28 also reported that academic stress was a significant influence on the health promotion of nursing students, similar to the results of this study.

Based on the above findings, university students’ smoking is likely to cause mental health problems as well as physical health problems, and hence will need to look for effective stress-intermediation programs that affect smoking, drinking and health promoting behaviors.

**Conclusion**

The purpose of this study was to investigate the relationship between stress, drinking, smoking, and health promoting behaviors and to investigate the effects of stress on drinking, smoking, and health promotion behaviors in college students. There was a significant positive correlation between stress, alcohol and smoking, and there was a significant negative correlation between stress and health promoting behaviors. Factors influencing stress identified in this study were drinking, smoking, and health promotion behaviors. This study is meaningful in that it provided the basic data for preparing the nursing intervention plan which understands the factors affecting the stress of college students and reduces the stress. However, since this study was conducted only for university students in some areas, repeated research on university students with various characteristics of various areas should be conducted for the generalization of research.

**Ethical Clearance** - Not required

**Source of Funding**- This study was supported by Research Grant from Namseoul University.

**Conflict of Interest**- Nil

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3. Park DH, Kim HJ. The factors, which affect the problem drinking behavior of college students. JEAS. 2017, 12(SP22): 6167-72. DOI:10.3923/jeasci.2017.6167.6172


Mediating Effects of Social Networks (SNs) in the Relationship between Perceived Health Condition (PHC) and Health-related Quality of Life (HRQOL) in Community Dwelling Elder

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Abstract

Background/Objectives: Purpose of this study was to identify the relationship between the perceived health condition (PHC) of the elderly and the health-related quality of life (HRQOL) and to confirm the mediating effect of the social networks (SNs) in their relationship.

Methods/Statistical analysis: This study was a descriptive study and collected data using questionnaires for 210 elderly people who use the elderly welfare center as an elderly person living in J-gun, C-city, Chungbuk.

Findings: The PHC of the elderly had an effect on the mediator SNs (β=.548, p<.001), PHC had an effect on the health related quality of life, which is a dependent variable (β=-.664, p<.001). As a result of examining the effect of the mediator’s SNs on the HRQOL, which is a dependent variable, PHC (β=-.521, p<.001) and SNs (β=-.262, p<.001) showed a significant predictor of HRQOL.

Therefore, the SNs played a role of mediator and influenced the relationship between PHC and HRQOL of the elderly, and the degree of PHC and SNs explaining HRQOL was 48.9%.

Improvements/Applications: By examining the mediating effect of the SNs in relation to the PHC of the elderly living in the community and HRQOL, the researcher has prepared a plan to maintain and promote the elderly in a healthy old age.

Keywords: Community, Elderly, Social networks, Perceived health condition, Health-related quality of life

Introduction

Korean population is rapidly aging since the elderly population exceeded 7% in 2000 and reached 13.8% in 2017.¹ The life expectancy of Korean is as high as 82.3, but the health expectancy is 73.2 which indicate average 9 years of diseases.² Considering the relatively lower health expectancy compared to fast aging speed and life expectancy, there is a need for efficient response to the future population structure and increase of chronic disease. Especially, according to national survey on the elderly life, 89.2% of elderly suffer from chronic disease, and complex morbidity rate over 2 diseases is 72.3%, which indicates urgent need for management of chronic disease.³ Most common diseases that the elderly suffer are chronic disease such as hypertension, osteoarthritis and diabetes.² Thus, it is most important for the elderly to prevent chronic disease, and conduct proper treatment and management after early discovery. As medical and welfare expense due to disease will increase in the future, it is highly desired that the direction of health support policy for the elderly should aim for extension of health expectancy. Regarding this issue, the 4th National Health Plan (2016~2020) that has been recently published includes health policy such as practicing healthy living, management of chronic degenerative disease and risk factors to extend health expectancy.⁴

Meanwhile, 32.4% saw health condition of Korean elderly was good while 43.7% saw it otherwise, which...
indicates higher proportion of those who evaluate PHC negatively. Especially, in age group from 80 to 84, 46.2% saw their health condition negatively. It indicates the elderly are concerned about their actual health condition, so there is a need to improve HRQOL through health management and health improvement for extension of health expectancy and positive recognition toward PHC.

WHO defined QOL as the individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, and that various factors such as health, family, personal relationship, role performance, leisure activity and SNs affects quality of life of elder.

Considering factors that could play mediating role to improve HRQOL by improving subjective PHC of elderly and improving HRQOL of elder as higher health condition of elderly reduces disease symptoms due to positive attitude and perception toward health and improvement of belief toward health and health activity leading to gradual improvement of physical function, SNs, the major concept to this role comes up in the field of nursing.

Social support of elderly is an influential factor to mental health. Positive emotional expression and behavioral support is known as major cause of creating interaction among people. SNs refers to social contact which is used together with social support, but emphasizes on network scale, homogeneity of members, frequency of contact and opportunity of sharing support. Perception about such SNs is known to create subjective happiness by satisfying needs for stability and reliability toward oneself, improve physical health condition in accordance with network scale, and pose positive influence of life satisfaction, which enables expectation that SNs is a variable that improves HRQOL.

As for the influential factors to HRQOL of Korean elder, the general characteristics are age, gender, spouse, education, income, and number of chronic disease, and there were exercise, PHC, stress, depression, suicidal thoughts, self-symptom experience, IADL, abdominal obesity, residence, local community spirit, SNs and health improvement behavior. Also, SNs have been reported as an effect factor to HRQOL of elderly. Likewise, PHC was reported as an influential factor to HRQOL of elder, but researches verifying the mediating effect of SNs in relation between PHC and HRQOL of community dwelling elder.

METHODS

Research design

Study is a descriptive correlation research conducted to check mediating effect of SNs in relation between PHC and HRQOL of elder.

Subjects

This study conducted convenience sampling targeting elderly going to senior welfare center, elderly school and silver hall from J-gun, Chungbuk region, explained purpose and method of study, and selected 230 subjects who understood the contents and allowed to voluntarily participate in the study. The standard of selecting subject is elderly who are over age 65, not diagnosed with Alzheimer’s, able to conduct independent activity, with clear consciousness, able to communicate well, and those who are unable to understand questionnaire were excluded from the research. The number of sample was calculated as 178 with effect size .15, significance level .05, test power .95 and 11 predictive factors for multiple regression analysis from G*Power 3.1.9.2 Program, but selected 230 samples regarding wastage rates. Excluding 20 copies of questionnaire with insincere answers, the study used total 210 copies in analysis.

Instruments

PHC

The study used a tool exploited by Lawston et al., that was translated and revised by Shin to measure PHC. The tool is composed of 3 questions with 5-point scale consist from ‘very bad (1)’ to ‘very good (5)’. The score ranges from 3 to 15, higher score indicating higher PHC. The credibility of test tool when it was developed was Cronbach’s $\alpha=.91$, and it was .93 for this study.

HRQOL

The study used KEQ-5D in Korean which completed cross-cultural adaption and validation process based on EQ-5D which was exploited by EuroQol Group and is used in many countries as its credibility and validity has been confirmed. EQ-5D is a multidimensional preference based HRQL measuring tool, and is composed
of 5 categories (motor ability, self-management, daily activity, pain/inconvenience, anxiety/depression). Each question is answered by 3-point scale; ‘no problems (1)’ to ‘extreme problems (3)’, and the score ranges from 3 to 15, lower score indicating higher QOL. The credibility of the tool in this study was Chronbach α=.80.

**SNs**

The study used SNs tool developed by Lee.21 The tool is composed of 15 questions with 5-point scale; 5 questions about social participation, 5 about self-development activity, 5 about family activity. Questions are answered by Likert’s 5-point scale from ‘Not at all (1)’ to ‘Very often (5)’, as higher are indicating higher level of SNs. The credibility of test tool when it was developed was Cronbach’s α=.88, and it was .90 for this study.

**Data collection**

Data were collected from January 3 to 31, 2018, and before collection, the researchers explained purpose and method to the head of senior welfare center and silver hall and obtained consent. Data collection was conducted by researcher and 5 assistant researchers composed of juniors from nursing college. To ensure the accuracy of data, there was a preliminary meeting to train data collection method and explain study purpose, and to discuss expected questions and their responses. To collect data, the study used structured questionnaire, and for subjects who had difficulty filling in questionnaire alone, researcher and assistant researchers read questionnaire and helped recording answers.

**Data Analysis**

SPSS/WIN 23.0 program was used to process the data extracted from the first analysis. The general characteristics of subjects were expressed in real numbers and percentage. Average and SD were calculated for the PHC, SNs, and HRQOL of subjects. In addition, Pearson’s correlation coefficients were computed for the relationship among them and multiple regression was conducted to analyze the mediating effect of SNs in the relation between PHC and HRQOL.

**Ethical consideration**

The purpose, method and guarantee of rights of study subject of this study was approved by K University IRB (KNU_IRB-2017_41), and the study abided by the research ethics guideline during the entire process of study. The purpose and method of this study was explained to subject upon data collection, including that subjects can withdraw participation at any time. Also, subjects signed written consent forms including explanation that the collected data is only used in study, and guarantees anonymity and autonomy. Retrieved questionnaire were processed to put into computer system after collection, saved in a locked device, and will be shatter after 1 year of the study.

**Results**

**General characteristics (GCs) of subjects**

The mean age of subject was 72.86. The most common age group was the 70s with 99 subjects (47.1%), and there were 150 female (71.4%), 123 subjects with spouse (58.6%). As for the single household, there were 131 subjects (58.5%) who were not from single household, 130 subjects with religion (61.9%). As for the education, there were 70 subjects who were elementary school graduate (33.3%) and 47 who had no education (22.4%). As for the occupation, 155 subjects did not have job (73.8%). As for the exercise, 107 subjects answered they sometimes exercise (51.0%), followed by 60 who regularly exercise (28.6%), and 43 who never exercise (20.5%)[Table 1].

**Table 1: GCs of subjects (N=210)**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Division</th>
<th>n(%)</th>
<th>M±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(year)</td>
<td>65~69</td>
<td>55(26.2)</td>
<td>74.86±7.17</td>
</tr>
<tr>
<td></td>
<td>70~79</td>
<td>99(47.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over 80</td>
<td>56(26.7)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>60(28.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>150(71.4)</td>
<td></td>
</tr>
<tr>
<td>Spouse</td>
<td>Yes</td>
<td>123(58.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>87(41.4)</td>
<td></td>
</tr>
</tbody>
</table>
Living alone | Yes | 79(37.6)
| No | 131(58.5)

Religion | Yes | 130(61.9)
| No | 80(38.1)

Education | No education | 47(22.4)
| Elementary school graduate | 70(33.3)
| Middle school graduate | 43(20.5)
| High school graduate | 32(15.2)
| University graduate or above | 18(8.6)

Occupation | Yes | 55(26.2)
| No | 155(73.8)

Exercise status | Regularly | 60(28.6)
| Sometimes | 107(51.0)
| None | 43(20.5)

PHC, HRQOL, and SNs of subjects

Average of PHC of subject was 8.28 (Range: 3~15 points), average of HRQOL was 7.44 (Range: 3~15 points) and average of SNs was 2.59 (Range: 1~5 points) [Table 2].

Table 2: PHC, HRQOL, and SNs of subjects

<table>
<thead>
<tr>
<th></th>
<th>M±SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHC</td>
<td>2.76±.85</td>
<td>1~5</td>
</tr>
<tr>
<td>HRQOL</td>
<td>1.48±.41</td>
<td>1~3</td>
</tr>
<tr>
<td>SNs</td>
<td>2.59±.82</td>
<td>1~5</td>
</tr>
</tbody>
</table>

Relation among PHC, HRQOL, and SNs of subjects

HRQOL of subject was highly correlated with PHC (r=.66, p<.001), with SNs (r=.55, p<.001), and SNs was highly correlated with health condition (r=.55, p<.001) [Table 3].

Table 3: Relation between PHCs, HRQOL, and SNs of subjects

<table>
<thead>
<tr>
<th></th>
<th>PHC</th>
<th>HRQOL</th>
<th>SNs</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHC</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRQOL</td>
<td>.66*(p&lt;.001)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SNs</td>
<td>.55**(p&lt;.001)</td>
<td>.55**(p&lt;.001)</td>
<td>1</td>
</tr>
</tbody>
</table>

Mediating effects of SNs in the relation between PHC and HRQOL

To verify the mediating variable of SNs in the process of PHC of subject affecting HRQOL, the study used 3-step regression equation. Before confirming the mediating effect of SNs, the assumption of regression analysis was confirmed, and the Durbin-Watson index regarding autocorrelation was 1.493~1.998, which indicated no autocorrelation of outlier. As for the multicollinearity among independent variables, the VIP index was 1.00~1.42 which is less than 10, confirming no multicollinearity, indicating this data was appropriate for regression analysis.

At first step regression analysis, PHC, the independent variable significantly affected SNs, the mediating variable (β=.548, p<.001). Thus, this study suggests mediating effect of SNs in relation between PHC and HRQOL. According to first step regression analysis, PHC, the independent variable significantly affected SNs, the mediating variable (β=.548, p<.001), the explanation power of SNs was 30.0%. At second step regression analysis, the independent variable significantly affected SNs, the mediating variable (β=.664, p<.001), and explanation power of HRQOL was 44.1%. To verify the influence of SNs, the mediating variable to HRQOL, the independent variable in third step, the study conducted regression analysis with PHC and SNs as predictor and health related quality of life as dependent variable, it was confirmed that the PHC (β=-.521, p<.001) and SNs (β=-.262, p<.001) were significant predictors of HRQOL.

In other words, the direct influence of PHC of elderly to HRQOL was β=-.521. And multiplication of influence of PHC to SNs (β=.548) and influence of SNs to health related quality of life (β=-.262), the value 0.143 refers to indirect influence of PHC to HRQOL via SNs. At this point, β value -.521 of PHC, the independent variable which is the direct influence was smaller than...
entire influence β value (−.664) of first step, indicating the mediating effect of SNs. Thus, SNs affected relation between PHC and HRQOL of elderly as a mediating variable, and the variable’s explanation power was 48.9%. For significance verification regarding the size of mediating effect of SNs, the study conducted Sobel test. As the result, it was confirmed that in relation between PHC and HRQOL, SNs was a mediating variable (Z=4.01, p<.001) [Table 4], [Figure 1].

**Table 4. Mediating effects of SNs in the relation between PHC and HRQOL**

<table>
<thead>
<tr>
<th>Step</th>
<th>B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>R²</th>
<th>Adj²</th>
<th>Additional R²</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step1</td>
<td>PHC→SNs</td>
<td>.532</td>
<td>.548</td>
<td>9.44</td>
<td>&lt;.001</td>
<td>.300</td>
<td>.297</td>
<td>89.23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Step2</td>
<td>PHC→Health Related Quality of Life</td>
<td>-.325</td>
<td>-.664</td>
<td>-12.822</td>
<td>&lt;.001</td>
<td>.441</td>
<td>.439</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step3</td>
<td>PHC, SNs→Health Related Quality of Life</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.489</td>
<td>.484</td>
<td>.048</td>
</tr>
<tr>
<td>1) PHC→Health Related Quality of Life</td>
<td>-.255</td>
<td>-.262</td>
<td>-4.40</td>
<td>&lt;.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) SNs→Health Related Quality of Life</td>
<td>-.132</td>
<td>-.262</td>
<td>-4.40</td>
<td>&lt;.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sobel test: Z=4.01, p<.001

![Figure 1. Mediating Effect of SNs](image)

**Discussion**

This study aimed to identify the mediating effect of the SNs for relationship between the PHC of the elderly and the HRQOL, and discuss from study results.

The average PHC in this study was 8.28 (range: 3~15 point) which was similar to a study targeting the elderly in local community and PHC of elderly from welfare center. It is also similar to the result of National survey on Elderly Life Conditions where 43.7% of Korean elderly perceived their health condition negatively, indicating the need of nursing to improve PHC of the elder. There is a need for the support of professionals for elderly to naturally accept the deterioration of physical function from aging, while managing health improvement behavior and disease regularly, and perceiving their own conditions positively.

The average HRQOL of this study was 7.44 (range: 3~15 points) which was lower than previous research targeting the elderly in local community and research targeting the elderly who took visiting health care service and the elderly from welfare center. Such result seems to be derived from the higher population of single household subjects than previous research or from older age of subject. According to previous research utilizing health survey result of community targeting the elderly, the HRQOL of the aged over age 80 was the lowest, and elderly from single household
It was confirmed that the PHC significantly influenced HRQOL16, and that the higher SNs is, the higher the perceived life satisfaction of elderly is.27 Also, a previous research14 confirmed that the higher the SNs are, the higher the social support and HRQOL is. In addition, it was confirmed that SNs provide significant support to elder and SNs of elderly with neighbor and friend significantly affects mental health of elder.28 Likewise, SNs are regarded as one of the significance decision factor of HRQOL of elder.29

Moreover, activity in social relation, independence and family relationship satisfaction in relationship with children were the core elements of SNs improving quality of life of elder.30 As elderly tend to have higher life satisfaction when they have wider SNs through active social participation and wider interpersonal relationship, it was confirmed that SNs of elderly is an important element of improving quality of life. As elderly experience deterioration of physical function, separation of spouse, family and friend by death, loss of social role and financial difficulty, they could maintain positive thoughts and improve crisis responsive ability through support from surrounding. Thus, there is a need to expand political and economical support to secure social participation and leisure activity to improve SNs of elder. Especially, as the increase of single household elderly intensified social isolation of the elderly, there is a need to expand elderly welfare service infrastructure focusing on community where single household elderly and vulnerable group can form SNs, enhance function of welfare service and expand social participation opportunities.

## Conclusion

This study aimed to check the mediating effect of SNs in relation between PHC and HRQOL to provide basic data for the development of nursing intervention affecting HRQOL of the elder. According to the result, it was confirmed that the PHC significantly influenced SNs, the mediating variable, and HRQOL, the dependent variable. And as for the verification of influence of SNs to HRQOL, the dependent variable, it was confirmed that PHC and SNs were significant predictors of HRQOL. As
positively PHC is very important to improve HRQOL of elder, there is a need to conduct health education and operate programs centering on the community. Also, as SNs played mediating role in relation between PHC and HRQOL of elderly, there is a need to expand political and economical support to secure social participation and leisure activity to improve SNs of elderly. Also, as the increase of single household elderly intensified social isolation of the elderly, there is a need to expand nurse-oriented elderly welfare service infrastructure where single household elderly and vulnerable group can form SNs, enhance function of welfare service and expand social participation opportunities.

**Ethical Clearance**: Not required

**Source of Funding**: This study was supported by 2017 Research Grant from Jungwon University(2017-045)

**Conflict of Interest**: Nil

**References**


The Effects of Foot Reflexology on Sleep Quality, Pain and Muscle Strength in Community Dwelling Female Elderly

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Abstract

Background/Objectives: The aim of this study was to evaluate the effects of foot reflexology as a nursing intervention, on sleep quality, joint pain, and muscle strength among female elders living in the community.

Methods/Statistical analysis: A quasi-experimental study was conducted using pre-posttest design. Participants were 35 female elders (aged 65 and over), allocated to control group (n=18) and experimental group (n=17). Thirty minute foot reflexology intervention was implemented three times per week for 4 weeks for a total of 12 sessions. Sleep quality, joint pain, and muscle strength were measured at baseline, after 2 weeks, and at the completion of the 4-week intervention. Using SPSS WIN 14.0, independent t-tests was used for homogeneity and paired t-tests were conducted to analyze effects of the intervention.

Findings: Statistically significant differences emerged in all dependent variables. The scores for sleep quality in the experimental group increased by 8.76±3.98 after 4 weeks (t=-4.97, p=.000). The joint-pain level of the experimental group decreased by 7.18±3.64 after 4 weeks (t=4.471, p=.000). The scores of the experimental group for leg-muscle strength increased by 11.71±2.64 after 4 weeks (t=14.60, p=.000).

Improvements/Applications: The findings suggest that foot reflexology was effective for female elders, improving sleep quality, reducing joint pain, and increasing muscle strength. As a nursing intervention, good use of foot reflexology would be a good health-promotion strategy for female elders in the community.

Keywords: foot reflexology, sleep quality, pain, muscle strength, female, elders

Introduction

In Korea, the elderly population has rapidly increased; those aged 65 and older comprised 7.2% of the population in 2000 and increased to 13.8% by 2017.¹ The population has more female elders than male elders that two of three elders are female (62.8%). Women are living about 6.2 years longer than men on average. In addition, aged women (92.2%) showed higher chronic or degenerative disease morbidity than men (74.4%).¹ Well-developed health-promotion strategies for elders, female elders in particular, would effectively reduce health costs and prolong the institutionalization of the aged population.

Old adults experience functional deterioration throughout the aging process. Some typical and high-prevalence health problems among the aged population include arthritis, insomnia, and physical weakness. The arthritis morbidity of the aged was four times higher than that of the population in general. The health condition of Korean female elders is worse because most aged women devoted their lifetimes to housework and serving their parents faithfully, but did not take care of...
themselves, including managing their own health. Sleep disturbance is another health problem such that female elders in particular showed lower quality of sleep than men.² Along with general weakness, elders suffer from low muscle strength in their lower extremities, which accompanies a high risk of falling.³

A significant increase emerged in the use of complementary and alternative medicines in hospitals as well as in community settings.⁴ Despite the rapid advance of medicine, fear of side effects from medicines and medical treatment and a strong desire to alleviate suffering has caused people to choose various complementary and alternative medicines.⁴ Understanding the possible advantages of alternative medicines and aiming to provide quality care, nurses have drawn their attention to various complementary and alternative medicines. Numerous nursing researchers found several effective modalities to use in nursing practice; reflexology is one of those.

Reflexology is an ancient practice using a form of foot- and hand-pressure therapy designed to improve nerve communication. This technique can be applied on hands, feet, and ears, aiming to harmonize physiological function and promote relaxation.⁵ Foot reflexology, in particular, uses a pressure technique to stimulate nerve endings on each foot. As a nursing intervention, it has been long recognized as a preventative and therapeutic method, especially for the elderly population. A previous study detailed the techniques and procedures of foot reflexology.⁶

The intervention has been practiced throughout history by various cultures.⁷ The effects of reflexology were revealed in several previous studies including reduction of psychological symptoms such as anxiety,⁸ and related symptoms including nausea, vomiting, and sleeplessness.⁷,⁹ Some physical problems were alleviated using this intervention, shown in studies that reported pain relief⁷,¹⁰ and fatigue.⁷,¹¹ The intervention was particularly effective in relieving headache, dysmenorrhea, back pain, cancer, and gout pain.⁷,⁹

Among variety types of reflexology, foot reflexology has been implemented by various providers including lay people and sports-related professionals.⁷,¹² Yet, few nurses provided many foot reflexology interventions and few were performed on the elderly population. Some modalities of the intervention require background knowledge, which may influence intervention effects. The elderly population has a risk of adverse outcomes, due to underlying diseases. In addition, participants’ safety can better be guaranteed because nurses are trained to handle and prevent adverse outcomes. With current resources and knowledge, nurses can effectively communicate the benefits of interventions to elders and implement the intervention in a safe way.¹³

The purpose of this study was to identify the effects of a four-week foot reflexology as a nursing intervention on sleep quality, knee joint pain, and leg-muscle strength among female elders in the community.

**Method**

**Setting and sample**

A quasi-experimental study was conducted with pre- and posttests to assess the intervention. Using experimental and control groups, the intervention was implemented at clubhouses (senior centers) for elders in Daejeon, Korea. Two senior centers were involved and people who had registered at each center were invited to participate; 35 female elders, aged 65 and older, participated in this study.

Participants were allocated into two groups: 17 in the experimental group and 18 in the control group. The eligibility criteria for participants were 1) the ability to communicate in Korea, 2) not using anti-hypertensive medication, 3) having no open wounds and fractures of the feet, 4) not having a psychiatric diagnosis, 5) not having hemorrhagic disease, 6) not having acute myocardial infarction and acute illness, 7) not having previous experience with foot reflexology, and 8) signing an agreement to participate in this study. All participants were aware that they were able to discontinue the intervention at any time. They were also educated on the possible adverse effects of foot reflexology and asked to report these to their provider as soon as a symptom or any discomfort appeared.

**The intervention and study procedure**

A 30-minute foot reflexology intervention was conducted three times per week for four weeks for a total of 12 sessions. The nursing intervention using foot reflexology consisted of four stages, shown in Table 1.
Table 1. Stages of foot reflexology

<table>
<thead>
<tr>
<th>Stage</th>
<th>Duration</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preparing stage</td>
<td>5 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subjects’ feet soak in the water of 40℃ and wiped them out with dry towel.</td>
</tr>
<tr>
<td>2</td>
<td>Relax massage stage</td>
<td>5 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Relax massage</td>
</tr>
<tr>
<td>3</td>
<td>Reflexo-massage stage</td>
<td>15 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflexo-massage</td>
</tr>
<tr>
<td>4</td>
<td>Ending stage</td>
<td>5 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drink warm water 300cc to facilitate elimination after reflex massage.</td>
</tr>
</tbody>
</table>

The research design is shown in Figure 1. Before the first session, data for the demographic characteristics of study participants and all dependent variables (sleep quality, joint pain, and leg-muscle strength) were collected. Two post evaluations took place, the first after two weeks and again at the end of the intervention at four weeks following the commencement of the intervention.

Measurement

Sleep quality: The Visual Analogue Scale (VAS) was used to measure sleep quality. Participants were asked to score on a 10-cm line with verbal anchors at each end: “didn’t sleep at all” (score 0) to “Slept very well” (score 10).

Joint pain: Pain was measured using the VAS. A 10-cm line with verbal anchors at each end ranged from “no pain” (score 0) to “the most severe pain I have ever had” (score 10).

Leg muscle strength: The leg-muscle strength of individual participants was assessed by timing how long the participant could hold both legs extended at a 45-degree angle.

Data analysis

The data analysis was performed using SPSS WIN (version 12.0). Differences between groups were examined using chi-square analysis for categorical data and independent t-tests were conducted to establish the homogeneity of dependent variables. For changes after two weeks and the final four-weeks of the intervention, paired t-tests were performed. Statistical significance was determined at \( p < .05 \).

Results

Homogeneity of demographical characteristics

The demographical characteristics of two groups are shown in the table 2. The findings of the homogeneity test indicate there were no statistically significant differences between two groups.

Table 2. Homogeneity test for demographic characteristics of groups

<table>
<thead>
<tr>
<th>Live with</th>
<th>Group</th>
<th>Mean±SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td>Exp. (n=17)</td>
<td>5.71±2.64</td>
<td>-4.97</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>-1.48± .85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spouse only</td>
<td>Exp. (n=17)</td>
<td>4.35±3.33</td>
<td>-4.71</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>-1.31±1.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married son</td>
<td>Exp. (n=17)</td>
<td>7.41±2.81</td>
<td>-5.47</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>3.39±.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Exp. (n=17)</td>
<td>3.95±2.69</td>
<td>-1.31</td>
<td>.209</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>-1.22±1.29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Homogeneity of dependent variables

The mean scores of sleep quality were 57.26±23.21 in the experimental group and 58.44±24.05 in the control group; the mean scores for joint pain were 54.47±17.69 and 54.28±21.24; the mean scores for leg-muscle strength were 30.18±5.77 and 29.94±6.38, respectively. No statistically significant differences emerged for the dependent variables in the baseline parameters [Table 3].

Table 3. Homogeneity test for dependent variables of groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Mean±SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep quality</td>
<td>Exp. (n=17)</td>
<td>57.29±23.21</td>
<td>-4.97</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>58.44±24.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint pain</td>
<td>Exp. (n=17)</td>
<td>54.47±17.69</td>
<td>-4.71</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>54.28±21.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg muscle strength</td>
<td>Exp. (n=17)</td>
<td>30.18±5.77</td>
<td>-5.47</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>29.94±6.38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Effects of foot reflexology

The scores for sleep quality of experimental group was increased by 5.71±2.64 after two weeks and increased further by 8.76±3.98 after 4 weeks (t=−4.97, p=.000). The joint pain level of experimental group was decreased by 7.18±3.64 after four weeks (t=−4.71), p=.000. The scores of experimental group for leg muscle strength were increased by 11.71±2.64 after four weeks (t=−14.60, p=.000). All changes of experimental groups were statistically significant. After four weeks, no statistically significant changes were found in scores for sleep quality and joint pain in control group. There was statistically significant increase of scores for leg muscle strength in control group [Table 4].

Table 4. Differences of dependent Variables between experimental and control groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Difference 1 Mean±SD</th>
<th>Difference 2 Mean±SD</th>
<th>Paired t (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep quality</td>
<td>Exp. (n=17)</td>
<td>5.71±2.64</td>
<td>8.76±3.98</td>
<td>-4.97(0.000)</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>-.78±2.69</td>
<td>.39±3.36</td>
<td>-1.48(0.158)</td>
</tr>
<tr>
<td>Joint pain</td>
<td>Exp. (n=17)</td>
<td>-4.35±3.33</td>
<td>-7.18±3.64</td>
<td>-4.741(0.000)</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>.22±3.61</td>
<td>1.06±3.96</td>
<td>-1.31(0.209)</td>
</tr>
<tr>
<td>Leg muscle strength</td>
<td>Exp. (n=17)</td>
<td>7.41±2.81</td>
<td>11.71±2.64</td>
<td>-14.60(0.000)</td>
</tr>
<tr>
<td></td>
<td>Cont. (n=18)</td>
<td>3.39±.85</td>
<td>5.17±1.04</td>
<td>-8.00(0.000)</td>
</tr>
</tbody>
</table>
Discussion

The aim of this study was to evaluate the effect of foot reflexology on female elders as a nursing intervention using complementary and alternative medicines. The results of this study show that foot reflexology has the potential to improve sleep quality, to reduce joint pain, and to increase leg-muscle strength. Study findings were consistent with previous studies, confirming the positive effects of foot reflexology.

An important principle of foot reflexology is to induce various effects by using active contact such as pressing or rubbing the foot reflex zone. By stimulating inactive body parts and soothing overactive parts, elderly women experienced overall balance in body energy, which generated beneficial effects physically as well as psychologically. Studies reported several complicating factors for deterioration of health status in female elders including lack of self-care strategies and low accessibility to the healthcare system. Considering the easy application of the intervention, the foot-reflexology intervention can become the predominant strategy for the female elderly population.

When the first post assessment was performed after two weeks, all dependent variables showed intervention effects in that study participants demonstrated strengthened leg muscle and reported improved sleep quality and reduced pain. In addition, the statistics further improved after four weeks of the intervention. The duration and frequency of the foot-reflexology intervention were diverse ranging from one day to 6 weeks, and up to 14 sessions in two weeks. Yet, we do not offer suggestions on optimal durations and sessions that would produce the best possible results. Future review is required to provide evidence-based information for health providers.

Most researchers who examined the effects of foot reflexology interventions reported statistically significant effects, showing that the intervention improved physical and psychological health in various populations. However, these reviews failed to describe subsequent follow up with participants following the completion of the intervention. Physical symptoms may appear immediately after discontinuation of the foot reflexology intervention.

Concerns related to the maintenance of intervention effects can be reduced by application of self-foot reflexology. Older adults without serious physical or psychological deficits can easily learn how to apply self-foot reflexology. Foot reflexology can be performed anywhere, requires no special equipment, is noninvasive, and does not interfere with the participant’s privacy. As a good strategy for self-care management, the effects of the intervention can be maintained, which may contribute to improvement in physical and psychological health in populations of female elders. Therefore, we suggest that nursing professionals teach elders population how to apply self-foot reflexology for self-care management.

Interestingly, statistically significant improvement occurred in leg-muscle strength in the control group. This may due to measurement error in that participants had gotten used to the device and performed better than the first assessment. Thus, further evaluation of the effects of foot reflexology on muscle strength is needed to determine true individual changes with proper strategies to prevent measurement error.

This study had several limitations. First, the research sample was a nonrandom convenience sample in the setting to which the researcher had access for data collection. In addition, the relatively small sample size raises concerns about the generalizability of study findings. Therefore, interpretation of study results should be performed with caution.

Conclusion

A four weeks intervention of foot reflexology was performed on female elders living in the community. The findings from this study revealed good potential to improve sleep quality, to reduce joint pain, and to increase leg-muscle strength. Foot reflexology may be an effective nursing intervention for aged women, especially those with sleep problems, joint pain, and muscle weakness. Thus, we suggest that nursing professionals implement foot reflexology for the aged population, especially female elders, as a health promotion strategy.

Ethical Clearance - Not required

Source of Funding - Self

Conflict of Interest - Nil


An Experimental Study on the Penetration of 850nm and 940nm Infrared Radiation into Porcine Tissues

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There have been a number of clinical studies on the effects of far-infrared (FIR) radiation on the human body. It is known that FIR radiation is absorbed in the epidermis of the human body, whereas near-infrared (NIR) radiation penetrates more deeply. However, no experiments have been carried out to determine how deeply NIR penetrates into tissues. This study investigated the penetration depth of NIR radiation into porcine tissue samples using light-emitting diodes (LEDs) with wavelengths of 850 and 940 nm to radiate the tissue samples. The IR signals were modulated at 38 kHz to enable lock-in detection at various sampling depths. The results showed that 940 nm radiation, which travels farther in air, penetrated 50 mm into the tissue samples, whereas the 850-nm radiation penetrated up to 65 mm. The shorter penetration distance of the 940 nm radiation was attributed to the wavelength dependence of water absorption, due to the high water content of the tissue samples. Various medical devices using NIR may be effective for human.

Keywords: Infrared rays, light-emitting diode, penetration depth, temperature, wavelength.

Introduction

Infrared Radiation (IR) is a kind of electromagnetic radiation used in various medical, military, and industrial areas. The wavelength range of IR electromagnetic radiation is from 750 nm to 100 μm. It is classified as near-IR (NIR), mid-IR (MIR), and far-IR (FIR)¹. Typically, a wave emitted at around 300K area is 9.7 μm and only FIR rays are converted into heat inside the human body². Both visible and ultraviolet rays are almost completely absorbed in the skin; however, NIR rays can penetrate more deeply. Especially, a 1,300 nm visible ray is almost absorbed in the water of skin layer, while under 900 nm ray in the near infrared areas has a specific spectrum to oxidase such as hemoglobin, myoglobin (oxygen carrier in the muscle cell), oxyhemoglobin, deoxyhemoglobin and cytochrome³⁻⁵. It is known that the NIR area above 700 nm, which is a long wave, is harmless to the human body and also penetrates into tissues strongly⁶⁻⁸. Apart from dissertations on the effects of the NIR on human skin and subcutaneous tissue, the study on optical characters which penetrates into the human body is as follows; the optical characteristics of NIR which penetrates into human skin and subcutaneous tissue used by Carlo inversion skill⁹, the movement of a photon in the murky medium¹⁰, diffusion of light in the murky medium¹¹ and penetration into the skin⁵,¹², etc. However, the effects of infrared rays on the human body are measured by simulation, and the research on this is limited. Thus, the effects of infrared rays' range on an organism should be measured.

In this study, NIR LED whose wave characteristics are 850, 940 nm was used. In the porcine tissue similar to a human one, some NIR sensors were located and the penetration depth into the flesh with different distances were checked¹³⁻¹⁷.

Method

The materials used in this experiment were as seen in Figure 1. The experiments were carried out using IR LEDs with wavelengths of 850 and 940 nm, and maximum output powers of 5 W. Receiver is 1838 integrated IR sensor, and control module is STC89C51*2 and 8-bit CPU. Carrier module timer is IC NE555, and display module is LCD 1602A. The samples used in this study were porcine tissues which were stored in a cool condition for 48 hours after separation from the body. The flesh was mainly from the loin of the
porcine tissues, because it can minimize the influence of adipose tissues. The porcine tissues were used due to their similarity to human tissues which were proven in the previous studies\textsuperscript{13-17}. The flesh samples were cut into cubic specimens, 15 cm in length, each weighing 1.5 kg. The samples were fixed in a container for the NIR penetration experiments.

![Figure 1. Used Parts and Block Diagram built in the Circuit](image)

So far, IR radiation has been generally detected by spectrometers. However, spectrometer measurements of NIR radiation include linear features from reflected sunlight; thus, it can be difficult to determine a base measuring point for zero signal. In this study, an IR communication circuit was used to detect the IR radiation, and all signals were transmitted and received using an STC89C51 8-bit CPU to prevent detection of other (either direct or indirect) IR radiation from sunlight. Digital signals from the transmitter were detected and analyzed for the characteristics of the penetration depth into the tissue samples. The light intensity of NIR was not detected but the existence of NIR signals were checked measuring the penetration depth into the organism. This made it possible to include the measure of the tail part that could be ignored in radiation spectrum. The temperature and humidity was 20\degree C\pm 10\% and 60\% \pm 10\%. The sample was also kept at a temperature of 20\degree C and measured. The thermometer was placed in the middle of the flesh. To avoid oxidized samples, three kinds of newly bought flesh were measured five times respectively. Diodes and NIR sensors were horizontally put in with 5 mm intervals.

**Result and Discussion**

Figure 2 shows the NIR penetration into the tissue samples. The power applied to NIR LED was 3 W and 4.8 V. The spectrometer and diode were placed on the surface of the sample. The result showed that NIR LED quantity decreased by 3 W as distance in the sample increased. Especially, the 850 nm signal penetrated farther than the 940 nm signal, and the measured signal strength was greatest. However, despite the distance increase, it was not easy to find the point where the NIR becomes zero. This is caused by the inflow of natural sunlight.

![Figure 2. Amount of Light Penetrating into Porcine Tissue as measured by Spectrometer](image)

Figure 3 shows the electric current measured with a power of 1 W from both the 850 and 940 nm LEDs, in the air and in the tissue samples. The signal from the 940 nm LED travelled farther in the air; however, in the tissue samples, the 850 nm signal penetrated farther than the 940 nm one. In other words, it can be seen that the change of a medium is influenced by the deepest penetration.

![Figure 3. The Electric Current Intensity of 1 W Infrared Ray in Atmosphere and Inside Porcine Tissue in Relation to Distance](image)

Figure 4 shows the electric current at different distances from the sample, measured by NIR sensors inside the sample. This was obtained by repeated figures on both the 850 and 940 nm LEDs, where the LED output power was fixed at 5 W. Although stable measurements were obtained in general, there was variation at distances < 20 mm, in which the LEDs were in close proximity to the IR sensor. These errors likely resulted from inconsistencies in the lens-shaped protrusion at the front of the LED chips or the protruding metal structure at the front of the IR sensors, as well as variations in the density of the tissue samples. The distance between NIR LED and NIR sensor becomes farther, the measurement figure of the sensor had a deviation of under 100 \( \mu \text{A} \) under the maximum 10\% level. However, the organism with a deviation of 20 mm depth maximally proved the experiment to be stable.
Figure 6 shows the electric current intensity from the IR sensor as a function of the penetration depth into the sample for both the 850 and 940 nm LEDs at various powers. The 850 nm IR signals were detected at greater penetration depths into the sample. The 940 nm LED at 5 W reached comparable penetration depths to the 850 nm LED at 0.5 W. Similar results were found when the spectrometer was used. These results do not tell us that it is not easy to analyze the base point by spectrometer but it is possible to analyze the penetration depth of light into an organism when the NIR sensor is used. This result does not coincide with the previous studies which presented that the longer the wave, the deeper the penetration depth in general. The previous studies showed that 1.3 μm optical signals are totally absorbed in water, which suggested that we may expect the 940 nm signal to exhibit a larger absorption of water than the 850 nm signal in the organism as it is closer to 1.3 μm. Accordingly, the penetration depth into organic samples depended more strongly in the wavelength than on the power of the LED.

Figure 6. The Electric Current Intensity from the Infrared Sensor inside the Organism in Relation to Varying Distances and Electric Power Applied to Infrared Light Emitting Diodes with 850 nm and 940 nm Rays

Conclusion

In this study, the penetration depth of the NIRs into the porcine tissue was identified. The IR signals with a wavelength of 940 nm exhibited longer penetration lengths in air; however, the 850 nm signals exhibited longer penetration depths in porcine tissue samples. The penetration depth increased with the power of the IR LED. This means that in this porcine tissue, the NIR penetration depends more on the wavelength than on current power. In this study, using NIR digital communication circuits, the NIR’s maximum reach into the porcine tissue was identified. It is significant that the
result of this study shows that the penetration depths of the two wavelengths (850 nm 0.5 W and 940 nm 5 W) were almost the same. This kind of basic research would help suggest a source of NIR’s influence on the human body. This study would also propose a source for development of devices for the improvement of clinical experiments. Based on this study, in the future, the penetration reach into the other organs in the body such as fat, blood, etc. is necessary.

**Ethical Clearance:** Not required

**Source of Funding:** This study was supported by 2017 Research Grant of National Research Foundation of Korea (2017-0655).

**Conflict of Interest:** Nil

**References**


Types of Suicidal Thinking in Adolescents: 
Q Methodological Approach

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Abstract

Background/Objectives: This study was conducted to identify the types of suicidal thinking in adolescents and to compile basic data on the mental health of adolescents by verifying their characteristics.

Methods/Statistical analysis: This study is an exploratory study with Q methodology applied to identify the different types of suicidal thinking in adolescents and describe the characteristics of each type.

Findings: As a result of this study, four types were identified. They were ‘those who abide by ethics’, ‘those with high risk for suicide’, ‘those who are impulsive and avoid reality’, and ‘those who empathize with suicide’. An increase in adolescents suicides means an increase in the potential risk group that can commit suicide.

Improvements/Applications: As such, prevention of suicidal thoughts is important. This researcher hopes that through the findings of this study, various programs that can reduce suicidal thoughts can be developed.

Keywords: Adolescents, Suicidal thinking, Q methodology, Type, Subjectivity

Introduction

For the past consecutive 11 years, Korea has been ranked top among members of the OECD (Organization for Economic Cooperation and Development) in terms of suicide rate[1]. In particular, while the suicide rate among adolescents in OECD countries has been decreasing since the 1990s, Korea has seen it increase. The number one cause of death of those in their teens, 20s and 30s in Korea was found to be suicide[1]. Statistics OECD, 2016).

In recent years, adolescents have taken extreme measures such as suicidal thinking or suicide attempts to artificially put an end to their lives. This deals a fatal blow of pain not to just oneself, but to his family and friends, and even contributes to anxiety and undermined mental health in the society making it a serious social issue. Suicidal thinking refers to overall thoughts or ideas regarding suicide[2]. It is the starting point that can lead to suicide and is a preceding factor closely associated with suicide attempts and suicide rates. Those who experience suicidal thinking during their adolescent years have an 11-fold likelihood to attempt suicide as an adult. Adolescents with suicidal thinking experience four times more of thoughts on suicide over the following four years since their initial suicidal thinking, compared to other adolescents[3]. An increase in adolescents with suicidal thinking means an increase in the potential risk group that can commit suicide, and thus prevention of suicidal thinking is important[4]. Therefore, more attention must be paid and measures developed for a systematic management of suicidal risks. Studies need to be conducted to identify factors that affect suicidal thinking in adolescents and their suicide attempts.

While there have been various studies such as the pathway analysis on suicidal thinking in adolescents[5], a study on suicidal thinking of adolescents[6], a longitudinal study on the initial suicidal thinking of adolescents[7], and a study on suicidal thinking in accordance with the degree of depression[8], there have been no qualitative studies on suicidal thinking of adolescents.

As such, this study will use Q methodology which values the perspective of the agent to systematically
analyze the subjective experience of suicidal thinking during the adolescent years to see how they categorize into different types, and what characteristics each type has. When the higher level question and the lower level question in each factor concluded from the Q factor analysis are interpreted as a single factor, their traits are immersed towards the middle, making the meaning ambiguous [9]. Meaning becomes richer when the higher level question and lower level question are divided in the interpretation. This also allows for a confirmation of a sub-type’s existence that may not be apparent in the Q classification [9].

As such, in this study, to clearly bring out the psychological traits of each, interpretation will be done separately for the higher level questions and lower level questions. In doing so, we expect to provide basic data for the development of an intervention program that can reduce suicidal thinking in adolescents by promoting better understanding of the various types of suicidal thinking.

In addition, given the reality of students that spend most of their time at home and school, identifying the types of suicidal thinking during one’s early adolescent years and verifying the characteristics of each type will have a positive impact on the mental health of adolescents even after they become full adults by providing basic data on suicidal thinking.

**Materials and Method**

**Design of the study**

This study is an exploratory study that applies Q methodology to verify the different types of suicidal thinking in adolescents and describe the characteristics of each type.

**Sampling method**

*Q The population and selection of a Q sample*: To collect Q statements, the statements concluded after literary review were used. From the data of preceding studies and expert literature on suicidal thinking in adolescents, a total of 170 statements were identified. Since life style can help verify the various feelings of people and thus allow for an understanding of the psychological code of life in accordance with the needs that each individual seeks to fill, and thus helps acquire the various meaning of issues related to one’s psychology [10], 16 ‘life style questions’ were added to select a total of 186 Q populations. To select the Q sample, Q populations were read repeatedly and categorized. The categories that were identified through this process were the five categories of thoughts of suicide, cause of suicide, prevention of suicide, opposition to suicide and empathy with suicide. After the review by two professors of nursing studies and being revised accordingly, the selected statements finally composed the 47 Q populations.

*Selection of the P sample*: In this study, P sample was consisted of a total of 54 middle school students selected for convenience sampling. These were students who gave their consent to the participation in the study and who were deemed to be able to express suicidal thinking well. Their average age was 14.0 years with a split of 43.3% male students and 51.9% female students. When asked about their satisfaction level with school life, 51.9% responded ‘good’, 40.7% responded ‘average’ and 6.7% responded ‘bad’. When asked whether they had received any health classes in the past year at school that focused on suicide, 40.5% responded positively <Table 1>.

*Q sample classification and data analysis*: The Q sample distribution was prepared accordingly to the principles of Q methodology, where the 47 statements selected as Q samples were distributed. For the classification, first the Q samples were grouped into three categories of positive, neutral and negative. The positive statements were ranked in descending order from the outside to the inside and concluded in the neutral area. Among the collected data, the one that was given the most negative response in the Q sample distribution was allocated 1 point and the one that was given the most positive response was allocated 11 points. To determine the most ideal factor number, an Eigen value of 1.0 was set before entering various factor numbers. The one that was judged the most reasonable given the calculated results and the total explanatory variance.

*Ethical considerations*: To ensure that this study meets ethical standards, an approval from the ethics board of S University was acquired before the start of the study (IRB No. SWCN-201705-HR-007). To uphold the rights of participants, they were given an explanation on the purpose and process of the study and ensured that the identity of participants would be kept anonymous before receiving a written consent from them. Participants were also informed that they may withdraw from the study at
Results and Discussion

Structure of Q types

To analyze the Q sorting using a total of 53 subjects, the QUANL program was used. Factor categorization was done based on an Eigen value of 1.00 that shows the degree of distribution that can be explained by factors. Perception of suicidal thinking was categorized into roughly two factors, with the two factors explaining 39.76% of the total variance [Table 2].

Table 1: Demographic Characteristics and Factor Weights of P sample (N=53)

<table>
<thead>
<tr>
<th>Type</th>
<th>ID</th>
<th>Factor weight</th>
<th>Sex</th>
<th>Religion</th>
<th>Academic performance</th>
<th>Friend support</th>
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### Table 2: Eigenvalue of Each Factor and Percentage of Variance (N=53)

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**Interpretation of factors and types**

Through brainstorming of the images that are conjured up from the representative statement and sub-representative statements extracted from the two factors, each type was given a name. The extracted two factors were interpreted into a total of 4 types, including the higher level type (those who abide by ethics and those with high risk of suicide due to a lack in their environment or relations) and the lower level type (those who avoid reality and those that feel a sense of relative loss).

Suicidal thinking at normal times is the mental state with a clear ethical standard on suicide and strongly reflects the subjectivity of suicidal thinking. Suicidal thinking that changes in relative terms seems to reflect the likelihood of having suicidal thinking when one feels that one is frustrated or lagging in certain aspects. The higher and lower level structures of each factor are as follows[Figure1].

**Figure 1. Type of Suicidal Thinking in Adolescents**

**The higher type of factor 1: Those who abide by ethical standards:** Students that fall into the higher type of factor 1 think that they can sufficiently overcome suicidal thinking through their willpower and effort (22), think that suicide can be prevented if they have someone they can confide in (20), think that children should abide by what their parents want (38), think that for a child to die earlier than his parents goes against the values of piety (26) and therefore abides by life ethics. In addition, they maintain social relations with people around them (46) and state that they are not satisfied with themselves when a certain standard is not met (40), indicating that they have an innate sentiment to work on their weaknesses through efforts. As such, they were named ‘Those that abide by ethical standards’<Table 3>.

**The lower type of factor 1: Those who are impulsive and avoid reality:** Students that fall into the lower type of factor 1 think that one has the freedom to die when they want to die (27), and stated that they have suicidal thinking when they feel a bruise to their ego or a sense of inferiority (1), when they feel frustration with the reality that is unlikely to change (9), or when they...
feel a burden to achieve a certain level in academics (15). They also stated that adolescents commit suicide out of impulse to avoid reality or to show rebellion (11), indicating that there is innate negative sentiments. However, they think that there is no reason to commit suicide if one has a clear dream for one’s life (21), and think that with the courage it takes to end one’s life, one should brave through life (23). Thus, students in this group were named ‘Those who are impulsive and avoid reality’.<Table 3>.

Table 3: Representative items (Factor 1)

<table>
<thead>
<tr>
<th>Representative statement</th>
<th>Z-score</th>
<th>Mean</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td>36. Being guaranteed one’s freedom must be given priority.</td>
<td>1.79</td>
<td>8.27</td>
<td>1.75</td>
</tr>
<tr>
<td>46. I maintain a friendly relationship with those online who share a common interest</td>
<td>1.75</td>
<td>6.00</td>
<td>1.32</td>
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<tr>
<td>40. I do not feel happy when I see myself not meeting the standards I set for myself.</td>
<td>1.73</td>
<td>7.24</td>
<td>1.65</td>
</tr>
<tr>
<td>38. Children must follow the opinion of parents.</td>
<td>1.64</td>
<td>4.78</td>
<td>2.67</td>
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<tr>
<td>22. Everything is up to how I think. Suicidal thinking can be overcome through my willpower and efforts</td>
<td>1.46</td>
<td>7.35</td>
<td>1.71</td>
</tr>
<tr>
<td>32. Men and women should be treated equally if they have the same capabilities and educational background.</td>
<td>1.36</td>
<td>8.08</td>
<td>1.86</td>
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<tr>
<td>44. Family issues must be resolved through consultation with all members (the couple and their children).</td>
<td>1.20</td>
<td>6.81</td>
<td>1.39</td>
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<tr>
<td>20. Suicide can be prevented if one has someone to confide in when faced with difficulty.</td>
<td>1.11</td>
<td>7.46</td>
<td>1.21</td>
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<tr>
<td>26. It is against the values of piety if a child dies before his parents.</td>
<td>1.00</td>
<td>6.22</td>
<td>2.17</td>
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<tr>
<td>1. I think of suicide when I experience a blow to my ego or feel inferior.</td>
<td>-2.19</td>
<td>4.54</td>
<td>1.38</td>
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<tr>
<td>9. I think of suicide when I feel that I am useless and feel frustrated with the reality that is unlikely to change.</td>
<td>-1.81</td>
<td>5.16</td>
<td>2.05</td>
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<tr>
<td>27. Since it is my life, I have the freedom to die whenever I want.</td>
<td>-1.56</td>
<td>5.43</td>
<td>2.47</td>
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<tr>
<td>11. Adolescents commit suicide on impulse to avoid reality or out of rebellion.</td>
<td>-1.52</td>
<td>6.49</td>
<td>1.48</td>
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<tr>
<td>15. Excessive interest by the parent in the child’s academic achievements or the university entrance exam that promotes extreme competition drives adolescents to suicide.</td>
<td>-1.47</td>
<td>6.89</td>
<td>2.63</td>
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<tr>
<td>23. If one has the courage to die, then one can use that courage to brave through life.</td>
<td>-1.36</td>
<td>7.27</td>
<td>1.50</td>
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<tr>
<td>21. There is no reason to commit suicide if one has a clear dream for his life.</td>
<td>-1.36</td>
<td>7.62</td>
<td>2.04</td>
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</table>

The higher type of factor 2: Those with high risk of suicide: Students that fall into the category of ‘Those with high risk of suicide due to a lack in the environment or relations’ think of suicide when they want to seek revenge on someone who treats them unfairly (4), when they experience stress in their relations with friends, family or teachers or when their family is undergoing financial stress (6), or when they engage in violent internet games (14). They state that they will think of suicide if the situation worsens (30) and that there is no reason to commit suicide if one is financially abundant (10), indicating that they come from families that are financially stretched and that they can think of suicide at any time. They also state that they would not choose suicide if they had at least one friend or parents who showed love and care for them (18) and noted that they do not pay much attention to what other’s think (42). These indicate that their interpersonal relations are under
stress and thus this group was named ‘Those with high risk of suicide’ <Table 4>.

The lower type of factor 2: Those who empathize with suicide: Students who fall into the category of ‘Those who empathize with suicide’ are diligent and hard-working (33), prefer jobs that are respected in society (43) and care about how others would view them (41). They think of suicide as something that negatively affects society and an unforgivable sin (25), but they also empathize with those who think of suicide when they feel inferior (1) or feel frustration with reality (9), or who think it’s better to die than to lead a difficult life (31). They also empathize with those who commit suicide after finding life to be over-burdening (29). Although they are against the idea of suicide, they are also empathetic of those who commit suicide when their life becomes too difficult. Thus, this group was named ‘Those who empathize with suicide’ <Table 4>.

Table 4: Representative items (Factor 2)

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<td>30. I might think of suicide if the situation worsens.</td>
<td>1.54</td>
<td>6.00</td>
<td>1.71</td>
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<tr>
<td>4. I think of suicide out of revenge on someone who treats me unfairly.</td>
<td>1.38</td>
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<td>6. I think of suicide because I feel frustrated at the financially difficult situation my family is in.</td>
<td>1.34</td>
<td>5.00</td>
<td>1.41</td>
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<tr>
<td>26. It is against the values of piety for a child to die before his parents.</td>
<td>1.27</td>
<td>5.63</td>
<td>2.24</td>
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<td>18. I would not choose to commit suicide if I had even one true friend or parents who cared for me.</td>
<td>1.26</td>
<td>7.31</td>
<td>3.17</td>
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<tr>
<td>2. I think of suicide when my relations with the family, friends (or boyfriend or girlfriend), or teachers are stressed.</td>
<td>1.15</td>
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<td>10. There is no reason to commit suicide if one is financially abundant.</td>
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<td>22. Everything is up to how I think. I can overcome suicidal thinking through my willpower and efforts.</td>
<td>1.07</td>
<td>6.63</td>
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<td>42. I tend not to care what others think of me.</td>
<td>1.05</td>
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<td>14. I feel an impulse to commit suicide when I play violent internet games.</td>
<td>1.02</td>
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Discussion

An increase in suicides by adolescents means an increase the potential risk group that may commit suicide. Therefore, the adolescent years is an important period for prevention of suicidal thinking. As such, this study was conducted to provide basic data for the development of an intervention program to reduce suicidal thinking, by identifying the subjective perception types towards suicidal thinking in adolescents and identifying the characteristics of each type. As a result of this study, four types were identified. They were ‘those who abide by ethics’, ‘those with high risk for suicide’, ‘those who are impulsive and avoid reality’, and ‘those who empathize with suicide’.

‘Those who abide by ethics’ think that suicidal thinking can be overcome through one’s willpower and efforts, that children should follow their parents’ will and that it goes against the values of piety for a child to die before his parents.
They maintain social relations with people around them and consider them unhappy when certain standards are not met. They work towards improving their weaknesses and lead a diligent life. ‘Those who are impulsive and avoid reality’ think that students have the freedom to die when they want to and think that adolescents commit suicide to avoid reality or to be rebellious. They tend to think of suicide out of impulse as they cannot overcome momentary challenges. ‘Those with a high risk of suicide’ thought of suicide when they wanted to seek revenge on someone who treated them unfairly, when their family was having financial difficulties, when their interpersonal relations were stressed, or when they were playing violent internet games. These students came from a financially difficult family and were likely to think of suicide at any time. They also had difficulty in their interpersonal relations. ‘Those who empathize with suicide’ think of suicide as negatively affecting society and an unforgivable sin but empathized with those who commit suicide because dying is better than leading a difficult life. Although they are against the idea of suicide, they tend to empathize with those who commit suicide because of their challenging reality.

**Conclusion**

Through these findings, this researcher hopes the various types of suicidal thinking in adolescents and their characteristics will be better understood so that the efforts to develop an intervention program to reduce suicidal thinking in adolescents can be accelerated. In addition, given the reality of students that spend most of their time at home and school, identifying the types of suicidal thinking during one’s early adolescent years and verifying the characteristics of each type will have a positive impact on the mental health of adolescents even after they become full adults by providing basic data on suicidal thinking.

**Ethical Clearance**—Taken from SWCN Institutional Bioethics Committee

**Source of Funding**—This study was supported by Research Grant from Changshin University (2018-5)

**Conflict of Interest**—Nil

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Ideation as Predictive of Psychopathology, Suicidal Behavior, and Compromised Functioning at Age 30. American Journal Psychiatry. 2006;163:1226-1232. DOI:10.1176/appi.ajp.163.7.1226


Antibacterial Effect of Sambucus Williamsii Var. Coreana NAKAI (S. Williamsii) against Enterococcus faecalis (E. faecalis) for the Traditional Treatment of Oral Diseases

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Abstract

Background/Objectives: This study investigated the antibacterial effect of Sambucus williamsii var. coreana NAKAI (S. williamsii) extract, a natural substance, against Enterococcus faecalis (E. faecalis), the main bacteria that cause root canal infection.

Methods/Statistical Analysis: To investigate the antibacterial effect of S. williamsii extract made with 70% ethanol against 24-hour-cultured E. faecalis (ATCC 4083), the extract was diluted with 0, 5, 10, 20, 30, and 40 mg/ml. To observe the effect based on time, the colony-forming units (CFUs) and viability were measured after culturing at 37ºC for 6 and 24 hours. The changes by concentration and time were analyzed using SPSS, with a 5% significance level.

Findings: After 6 hours, the CFU calculation results were 0 mg/mL (7.4×10^7), 5 mg/mL (1.1×10^4), 10 mg/mL (1.1×10^3), 20 mg/mL (2.7×10^2), and 40 mg/mL (1). These results showed a decrease in the bacterial growth rate as the concentration of the extract increased. Furthermore, the CFUs after 24 hours were 0 mg/mL (1.0×10^11), 5 mg/mL (2.9×10^7), 10 mg/mL (2.8×10^6), 20 mg/mL (2.4×10^3), 30 mg/mL (0), and 40 mg/mL (0), which showed a clear antibacterial effect from the bacterial growth suppression as the concentration increased. Over time, definite bacterial suppression was shown in 40, 30, and 20 mg/ml, and in particular, 40 mg/ml showed complete bacterial death. The minimal inhibitory concentration (MIC) was 20 mg/ml, while the minimum bactericidal concentration (MBC) was 30 mg/ml after 6 hours and 40 mg/ml after 24 hours, which showed an increasing antibacterial effect against E. faecalis as the concentration increased. These values also confirmed the non-existence of bacteria.

Improvements/Applications: S. williamsii extract showed an excellent antibacterial effect against E. faecalis, a natural substance that can substitute for the existing chemical substance. It is considered that developing root canal treatment using S. williamsii extract will enable biocompatible root canal treatment.

Keywords: Sambucus williamsii var. coreana NAKAI (S. williamsii), Enterococcus faecalis (E. faecalis), pulpitis, antimicrobial effect, endodontic

Introduction

Pulp and periapical diseases are bacterial infectious diseases. Representative dental caries and periodontal disease caused by the bacteria frequently developed in the oral cavity cause periapical diseases through pulp necrosis and bacterial infiltration of the root apex.[1]

Endodontic treatment is a process of eliminating the infected pulp, the infected dentin, and the microorganisms and their products from the pulp.[2] The main purpose of this treatment is to remove the bacterial lesion and to prevent apical infection from developing into apical periodontitis.[3] Such pulp and periapical lesions are caused by the bacterial infiltration, and are persistent. It is known that root canal treatment can eliminate the causes of such diseases, resulting in more than 90% healing and symptom alleviation or loss.[4] A prospective study observed the success and failure
results of the subject patients 4-6 years after their root canal treatment based on the same protocol, and showed an 86% success rate in the usual-root-canal-treatment group\(^5\)-\(^8\). Such study results showed that it is difficult to maintain a sterile status in the root canal with only the currently used root canal treatment method, and that causal bacteria remain after the treatment. Therefore, the main cause of endodontic treatment failure is the remaining bacteria in the root canal after treatment. Thus, studies on the related bacteria are necessary for investigating pulp and periapical diseases.

In a study to investigate the specific bacteria related to root canal treatment failure, Enterococcus faecalis (\textit{E. faecalis}) was found to be the most common and prevalent bacterium among the several existing bacteria\(^9\), and it is known that a higher rate of \textit{E. faecalis} is observed in the case of root canal treatment failure\(^10\). \textit{E. faecalis} produces various toxic materials, which attenuate the immune defense mechanism, and has an ability to survive and reproduce in an environment with a limited energy source\(^11\). Recently, it was shown that this bacterium has strong resistance to the drug in the root canal due to the biofilm formation in the root canal environment\(^12\). No other bacterium observed in the root canal has been shown to have strong resistance to the treatment. Therefore, there is a need to remove the formed biofilm or to eliminate \textit{E. faecalis} to increase the success rate of root canal treatment.

Many studies have been conducted to investigate the effects of various endodontic irrigants and drugs on \textit{E. faecalis}, to boost the success rate of endodontic treatment and to completely eliminate infection\(^13\). The interest in a natural product that would substitute for the existing endodontic irrigants and drugs is rising, along with the interest in natural products. Thus, this study was to confirm the antibacterial effect of the natural product Sambucus williamsii extract from Sambucus williamsii var. coreana NAKAI (listed as S. williamsii in Korean Herbal Pharamcopeia) against \textit{E. faecalis}, and to suggest its use for biocompatible root canal treatment based on the study results.

**Materials and Method**

**Bacterial culture conditions**

\textit{E. faecalis} (ATCC 4083) was used and grown in brain heart infusion (BHI; Sigma-Aldrich, St. Louis, MO, USA). \textit{E. faecalis} was cultivated overnight in liquid media incubated at 37°C. The cell was diluted approximately 1×10\(^7\) colony-forming units (CFUs) per milliliter.

**S. williamsii preparation**

The S. williamsii used in this study was purchased from Foodsynergy Co., Ltd. (Seoul, South Korea). After adding 70% methanol 5 times to 100 g crushed S. williamsii, an extract was obtained at 60°C for 12 hours. The extract was filtered using Whatman No. 2 filter paper, and was then concentrated using a rotary vacuum evaporator (N-1300E.V. S. EYELA Co., Tokyo, Japan) at 40°C. The concentrated S. williamsii extract was then lyophilized using a freeze dryer (FD5508, Ilshin Lab, Yangju-kun, Kyunggi-do, South Korea) to obtain S. williamsii powder. The final samples were stored at -20°C until use. They were dissolved in dimethyl sulfoxide (DMSO) at a 0.1 g/ml concentration.

**Antimicrobial effect of S. williamsii**

For the experiment, 100 μl cultured \textit{E. faecalis} (1×10\(^7\) CFU/ml) was inoculated into a 24-microwell plate containing S. williamsii extract at each concentration (0, 5, 10, 20, 30, and 40 mg/ml). The total volume of each culture medium was 1 ml. This microwell plate was anaerobically incubated at 37°C for 6 and 24 hours, and then the \textit{E. faecalis} in each well was uniformly smeared in an agar medium and then cultured at 37°C for 24 hours to confirm the number of CFUs present.

**Statistical Analysis**

Student’s t-test was conducted to identify the changes after 6 and 24 hours. The difference in each concentration was evaluated through one-way analysis of variance (ANOVA) followed by the Tukey test (p <0.05). Significant analysis was carried out using SPSS (Ver 21.0 SPSS Inc., Chicago, IL, USA).

**Results and Discussion**

Pulp and periapical diseases are known as infectious diseases caused by bacterial infection, and all the bacteria existing in dental plaque can break into pulp tissues\(^14\). In particular, in the case of immunocompromised patients, pathogenic bacteria infiltrate the root apex due to pulp tissue necrosis, and cause a periapical disease\(^15\). As such, it has been reported that bacteria play a crucial role in the pathogenesis and progression of apical lesions\(^16\). Therefore, the success of root canal treatment is possible
only after thorough and effective endodontic infection removal.

Although mechanical removal such as through canal preparation is very effective in removing bacteria infection in the root canal [17], it is confirmed that existing endodontic treatment tools cannot remove all periapical lesions [18]. Therefore, chemical processes like root canal irrigation using root canal irrigants as well as intracanal medication is essential to remove the infected pulp tissue with a complex anatomical structure in the root canal, and the bacteria [19]. Based on these processes, the bacteria from the infected root canal system must be reduced [20]. Intracanal irrigation is an important method of removing the residuum in infected pulp, and of reducing the bacteria in a lesion that cannot be mechanically removed due to an anatomical irregularity [21,22]. When the infection is persistent after general treatment, however, or when continuous pain or intracanal effusion exists, an antibacterial agent is necessary to eliminate the intracanal bacteria [23]. Studies have been actively conducted on root canal treatment to investigate the ways of minimizing the mechanical and chemical irritation to the periapical tissue while maintaining the sterile status of the root canal [24].

*E. faecalis* is an anaerobic gram-positive bacterium, has a one- or two-spherical/short-chain shape, and is found after root canal treatment failure [25]. It is known that if *E. faecalis* is not removed from the root canal and survives or infiltrates the root canal, it will cause root canal treatment failure [26]. If bacteria infiltrate the area around the filler due to microleakage after filling, it can cause continuous symptoms and pain due to the persistent periapical lesion, and will also result in the failure of the root canal treatment [27]. Many studies have been conducted to investigate the effects of many intracanal irrigants and medications on *E. faecalis* [28]. Although there are various existing medications and methods, continuous studies on substances that can completely eliminate bacteria causing root canal infection are needed. Even though there is an increasing interest in natural products, the studies on natural products related to the treatment of root canal infection are very limited. Therefore, this study investigated the antibacterial effect of Sambucus williamsii (S. williamsii), a natural product, against *E. faecalis*, the major bacteria causing periapical diseases in the oral cavity, by time, to determine if S. williamsii extract can be utilized as an intracanal irrigant and medication.

As shown in Figure 1, the antibacterial effect of S. williamsii extract against *E. faecalis* increases as its concentration increases. Figure 1(A) shows the application of S. williamsii extract after 6 hours, with CFU counts of 0 mg/mL ($7.4 \times 10^7$), 5 mg/mL ($1.1 \times 10^8$), 10 mg/mL ($1.1 \times 10^8$), 20 mg/mL ($1.1 \times 10^8$), 30 mg/mL ($2.7 \times 10^8$), and 40 mg/mL (1), which showed a decrease in the colony count with decreasing extract concentration. At 40 mg/ml, clear extinction was shown due to the antibacterial effect of the extract against *E. faecalis*, with CFU counts after 24 hours of 0 mg/mL ($1.0 \times 10^1$), 5 mg/mL ($2.9 \times 10^7$), 10 mg/mL ($2.8 \times 10^8$), 20 mg/mL ($2.4 \times 10^8$), 30 mg/mL (0), and 40 mg/mL (0). As the concentration increased, the antibacterial effect became stronger due to the much stronger reaction with the extract and the inhibition of the colony count. In particular, the 30 mml and 40 mg/ml concentrations showed much stronger antibacterial effects, and the 20 mg/ml concentration also showed a higher antibacterial effect compared to that after 6 hours [Figure 1(B)]. It was confirmed that suppression started at 20 mg/ml and that as the S. williamsii extract concentration increased, more definite extinction occurred in time.

![Figure 1. Antibacterial Activity of S. williamsii Extract against *E. faecalis* (A) after 6 h and (B) after 24 h](image-url)
antibacterial effect was shown after 6 hours by the S. williamsii extract concentrations of 40, 30, 20, 10, and 5 mg/ml, there were no statistically significant differences between the groups with S. williamsii extract (p=0.023). The antibacterial effect after 24 hours, however, was shown to have been much stronger with the S. williamsii extract of 40, 30, 20, and 10 mg/ml, and among the S. williamsii extract groups, the 40, 30, 20, and 10 mg/ml groups showed higher antibacterial effects than the 5 mg/ml group (p=0.000). For the antibacterial effect after 6 and 24 hours, the growth rate of E. faecalis was shown to have significantly increased over time (p=0.000). Although there were no significant differences over time among the 40, 30, and 20 mg/ml concentrations, the 5 and 10 mg/ml concentrations showed significant differences between after 6 and 24 hours. This shows the complete suppression of the bacteria at the 40, 30, and 20 mg/ml concentrations over time, and it was confirmed that the bacteria were completely extinguished by the 40 mg/ml concentration. Also, the antibacterial effect of S. williamsii extract was shown clearly after 24 hours than after 6 hours with the 30 mg/ml concentration, confirming that the bacteria did not grow. Furthermore, the minimal inhibitory concentration (MIC) was 20 mg/ml, and the minimum bactericidal concentration (MBC), where there are no bacteria, was 30 mg/ml after 6 hours and 40 mg/ml after 24 hours, showing increased antibacterial effect against E. faecalis as the concentration increased.

Chlorhexidine digluconate (CHX) is a chemical antibacterial agent that has been broadly used as an intracanal irrigant, and it has been shown to be as effective as NaOCl in terms of antibacterial effect [33]. CHX has an antibacterial effect against gram-negative and gram-positive bacteria, and also an antifungal effect [34], and has a persistent antibacterial effect after absorption by dentin [35]. It has been reported, however, that its long-term use may cause a burning sensation, and that its antibacterial effect is lower in gram-positive bacteria than in gram-negative bacteria [36]. Ethylenediamine tetraacetic acid (EDTA) removes the smear layer and inorganic substances and can inhibit biofilm development [37]. It has been reported, however, that despite its high antifungal effect, its antibacterial effect is very low, and it does not have a bactericidal effect [38].

Therefore, this study used a natural substance, S. williamsii, which belongs to the Caprifoliaceae class Eldeberry order and is a deciduous shrub growing in the mountain wetlands and valleys. Recent studies identified its antioxidant effect [40], its modern anti-inflammatory effect, its efficacy on osteoporosis, and its significant results on arthritis [41,42]. The studies on it in the oral cavity field, however, especially on its antibacterial effect against the oral-cavity bacteria, are insufficient. S. williamsii has not been used in association with dental diseases, and its related efficacy has not been identified. This study showed S. williamsii extract’s sufficient antibacterial effect against E. faecalis, a major bacterium causing root canal infection, and suggested its use as a substitute for chemical root canal treatment, as a natural substance. Therefore, it is considered that S. williamsii extract will become an important natural antibacterial substance in the dental field against E. faecalis, a major bacterium causing pulp and periapical diseases, based on its excellent antibacterial effect.
Conclusion

Based on the results, Sambucus willimsii (S. willimsii) extract has an antibacterial effect against *E. faecalis* at concentrations from 20 mg/ml, and completely extinguishes bacteria from the 30 mg/ml concentration after 24 hours compared to after 6 hours with 20-40 mg/ml concentrations, when it exhibited a clear antibacterial effect. Furthermore, this study suggests that the development of S. willimsii extract as a substitute root canal treatment for the existing chemical substance used will make it possible to treat periapical diseases.

**Ethical Clearance - Not required**

**Source of Funding -** This study was supported by a 2018 research grant from Kangwon National University (No. 620180021), and by Basic Science Research Program through a National Research Foundation of Korea (NRF) grant funded by the Ministry of Science, ICT, and Future Planning (2017R1C1B5074410).

**Conflict of Interest - Nil**

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41. Mitchell RA, Metz CN, Peng T, Bucala R.

A Study on Parenting Stress in Mothers of Preschool Children with Disabilities: with Priority Given to Preschoolers with Intellectual Disabilities and Autistic Disorders

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Abstract

Background/Objectives: The purpose of this study was to examine the parenting stress of 72 selected mothers of preschool children with intellectual disabilities and autistic disorders.

Methods/Statistical analysis: As for research method, Korean Parenting Stress Index (K-PSI) was put to use. This instrument consists of three subareas: parental distress, parent-child dysfunctional interaction and difficult child. A five-point Likert scale was used in each item, and the total number of the items was 36.

Findings: The findings of the study were as follows: First, there was a lot of parenting stress among the mothers of preschool children with disabilities in all the three subitems. The mothers whose children were five years old and whose children’s type of disabilities was autistic disorders were more stressed than the mothers whose children were at the age of five and whose children’s type of disabilities was intellectual disabilities, but no significant differences existed according to the gender of their children. Second, parental distress, dysfunctional interaction and difficult temperament were positively correlated with parenting stress.

Improvements/Applications: To improve the quality of life and mental health of mothers of preschool children with disabilities, differentiated family support should be provided in consideration of children’s type of disabilities and age.

Keywords: Parenting stress, mothers of preschoolers with disabilities, parental distress, parent-child interaction, difficult temperament.

Introduction

According to the family system theory, the birth of a child is a matter of utmost concern for his or her parents because everything that happens to one of the family members exerts direct and indirect influences on all the family members, no matter whether it is great or small. Not everybody is fully ready to become a parent, and mothers who are major caregivers may especially experience depression or stress on account of unexpected pain from parenting. In the case of infants without disabilities, the parenting stress of their mothers are negatively linked to the interaction behaviors and parenting efficacy of the mothers and their own development as well. A study found that parenting stress also is found in grandmothers and fathers who assist parenting, and that hypersensitivity and depression are predictors to provoke parenting stress. In addition, the negative relationship between parenting stress and parenting efficacy is found in multicultural families and low-income families as well.

Avidin argued that parent-child dysfunctional interactions are under the influence of parents’ parental distress and of children’s difficult temperament. Parents interact with their children in a negative manner when they have lots of pain from parenting and when the children have a difficult temperament, and such negative interactions affect the children’s development in a negative way. The birth of a child with disability is a tremendous challenge for his or her parents, and the parents are likely to experience realistic and psychological

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pain due to the children. According to a study\textsuperscript{8-15}, every parent who has children with disabilities\textsuperscript{14} experiences parenting stress irrespective of the type of disabilities, and the mothers experience a little more parenting stress than the fathers. As for studies by the type of disabilities, mothers of children with cerebral palsy\textsuperscript{16} undergo heavy parenting stress, and mothers of children with developmental disabilities\textsuperscript{17} show less paternal and receptive behaviors to their children when they find themselves to suffer from more stress. A study\textsuperscript{18} that investigated mothers of children with fluency disorder also discovered a negative correlation between parenting stress and parenting efficacy.

All the above-mentioned studies established that the parenting stress of parents who have children with disabilities is heavy. But not many studies have yet attempted to examine maternal parenting stress for preschool children with intellectual disabilities and autistic disorders only. In particular, children with intellectual disabilities and with autistic disorders respectively account for 53.9 percent and 12.8 percent of children of every age group who have disabilities and receive special education. When this fact is taken into account, it’s needed to deal with the parenting stress of mothers with these children in depth. An intellectual disability is a type of disability that there are difficulties both in intellectual functions and adaptive behaviors, and an autistic disorder refers to a disorder that there is something wrong with social interactions and communication and that shows restricted and repeated interest and activities. As modern society places importance on intellectual capacity, mothers may be a little more stressed over their children’s difficulty in intellectual capacity, and the parenting stress of mothers whose children suffer from autistic disorders may be heavy because of difficulty in social interactions. The purpose of this study was, therefore, to examine the parenting stress of these mothers as major caregivers in an attempt to provide some information on how to offer family support to stir up quality interactions between them and their children to ensure the best development of these infants and preschoolers with disabilities. Two research questions were posed:

-What is the parenting stress of mothers of children with intellectual disabilities and autistic disorders?

- Are there any correlations among parental distress, parent-child relationship and child temperament?

### Materials and Methods

#### The Subjects

The subjects in this study were 72 selected mothers who had preschool children with autistic disorders and intellectual disabilities. The general characteristics of the subjects are shown in Table 1.

#### Table 1. The general characteristics of the subjects

<table>
<thead>
<tr>
<th>Classification</th>
<th>Freq. (Person)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 and down</td>
<td>32</td>
<td>44.4</td>
</tr>
<tr>
<td>5</td>
<td>21</td>
<td>29.2</td>
</tr>
<tr>
<td>6 and up</td>
<td>19</td>
<td>26.4</td>
</tr>
<tr>
<td><strong>Child gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>49</td>
<td>68.1</td>
</tr>
<tr>
<td>Female</td>
<td>23</td>
<td>31.9</td>
</tr>
<tr>
<td><strong>Type of disabilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autism</td>
<td>27</td>
<td>37.5</td>
</tr>
<tr>
<td>Intellectual disabilities</td>
<td>29</td>
<td>40.3</td>
</tr>
<tr>
<td>Others</td>
<td>16</td>
<td>22.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>72</td>
<td>100.0</td>
</tr>
</tbody>
</table>

As for child age, the mothers whose children were four years old or younger made up the largest group that accounted for 44.4 percent, and the children of the second largest group that represented 29.2 percent were at the age of five. Those of the third biggest group that accounted for 26.4 percent were six years old or older. By child gender, 68.1 percent had male children, and 31.9 percent had female children. The former outnumbered the latter. By the type of disabilities, 40.3 percent that made up the greatest group had children with intellectual disabilities. 37.5 percent that were the second biggest group had children with autism, and 22.2 percent that were the third biggest group had children with other disabilities. When the mothers didn’t write the name of their children’s disabilities, their disabilities were classified as others.

#### Procedure and Instrumentation

The mothers whose preschool children had intellectual disabilities and autistic disorders were selected from among the mothers whose children attended special schools, special schools for early childhood,
independent kindergartens and affiliated kindergartens across the nation. 100 questionnaires were sent by mail, and the teachers in the schools were explained about the intent of this study over the phone before that. And they were asked to hand out the questionnaires to the mothers of children with intellectual disabilities and autistic disorders, to collect them from the mothers and then to send them back by mail. 72 completed questionnaires were gathered out of the 100 questionnaires. This study was implemented from February to June, 2018.

The instrument used in this study was Korean Parenting Stress Index (K-PSI), into which Abidin(1995)’s Short-Form of Parent Stress Index was standardized by Lee, Jung, Park and Kim in 2008. This instrument consists of three subareas: parental distress(PD), parent-child dysfunctional interaction(P-CDI), and difficult child(DC). A five-point Likert scale was used in each item, and there were 36 items in total.

The 72 collected questionnaires were scored online by logging onto Hakjisa Insight of Psychology, and a statistical analysis was carried out after the test results for each of the questionnaires were printed out.

As for the reliability of the instrument used in this study, the Cronbach alpha coefficient of it was 0.79, which is at a reliable level, as shown in Table 2.

Table 2. The reliability of the instrument

<table>
<thead>
<tr>
<th>Classification</th>
<th>The Number of the Items</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parenting Stress</td>
<td>36</td>
<td>0.79</td>
</tr>
</tbody>
</table>

Data Analysis

The collected data were analyzed by SPSS (statistical package for the social science) WIN 23.0. Concerning the analysis methods, statistical data on frequency and percentage were obtained to find out the general characteristics of the subjects, and another statistical data on mean and standard deviation were obtained to determine the parenting stress of the mothers of the preschoolers with disabilities. To investigate their parenting stress by the age, gender and disability type of their children, one-way ANOVA and t-test were carried out, and a correlation analysis was made to determine the correlations among parental distress, parent-child relationship, child temperament and parenting stress.

Results and Discussion

Parenting Stress in the Mothers of the Preschoolers with Disabilities

The parenting stress in the mothers of the preschoolers with disabilities is shown in Table 3. They got a mean of 100.24 in parenting stress out of 180. In regard to the subareas of parenting stress, they got a mean of 34.89 in parental distress, 30.35 in parent-child relationship and 35.00 in difficult child. The stress scores are higher than the scores in studies 7, 14. It can be inferred that the scores in study7 were lower because that study researched standardization and subsequently investigated young children without disabilities as well as those with disabilities, and it also can be inferred that differences in the disability types of the subjects might be the reason for the lower scores in study14 which investigated mainly cerebral palsy and developmental delay. But the findings of this study correspond to the findings of study12 that the ages and disability types of the subjects are similar to those of the subjects in this study.

Table 3. Parenting stress in the mothers of the preschoolers with disabilities

<table>
<thead>
<tr>
<th>Classification</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Distress(PD)</td>
<td>34.89</td>
<td>7.79</td>
</tr>
<tr>
<td>Parent-Child Dysfunctional Interaction (P-CDI)</td>
<td>30.35</td>
<td>6.06</td>
</tr>
<tr>
<td>Difficult Child(DC)</td>
<td>35.00</td>
<td>8.34</td>
</tr>
<tr>
<td>Parenting Stress</td>
<td>100.24</td>
<td>18.81</td>
</tr>
</tbody>
</table>

Parenting Stress in the mothers by the ages of the preschoolers with disabilities: The parenting stress of the mothers by the general characteristics of the preschoolers with disabilities is shown in Table 4. Among the subareas of parenting stress, parental distress was severest in the mothers whose children with disabilities were at the age of five, and the parental distress of the mothers whose children with disabilities were four years old or younger was lower than that of the other mothers. But the differences were not significant. Stress caused by parent-child relationship(F=4.04, p<.05) and by difficult child(F=3.79, p<.05) was heaviest among the mothers whose children with disabilities were five years old, and the mothers whose children with disabilities were at the
ages of four and down were less stressed than the others. There were significant differences according to the ages of the preschoolers. Overall, parenting stress was heaviest in the mothers whose children with disabilities were at the age of five, and the parenting stress of the mothers whose children with disabilities were four years old or younger was lower than that of the other mothers. The differences were statistically significant ($F=3.48$, $p<.05$). As a result of analyzing differences in parenting stress by the characteristics of the children, especially their ages, the mothers whose children were five years old were stressed out a lot in the areas of parent-child relationship and difficult child among the subareas of parenting stress. This finding coincides with the finding of study$^{14}$. Study$^{14}$ also found that the mothers whose children were five years old or older were more stressed than the mothers whose children were at the ages of four and down. It seemed because parenting stress gradually became heavier as the children got older due to their difficult temperament. But in study$^{7}$, parenting stress became lower as the children got older, and the reason seemed that the subjects included preschoolers without disabilities. Mothers who have preschoolers without disabilities find themselves to be less stressed as the children get older owing to their improved self-help skills.

Table 4. Parenting stress in the mothers by the ages of the preschoolers with disabilities

<table>
<thead>
<tr>
<th>Classification</th>
<th>Ages 4 and down (N=32)</th>
<th>Age 5 (N=21)</th>
<th>Ages 6 and up (N=19)</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Parental Distress (PD)</td>
<td>34.00</td>
<td>6.91</td>
<td>36.76</td>
<td>9.15</td>
<td>34.32</td>
</tr>
<tr>
<td>Parent-Child Dysfunctional Interaction (P-CDI)</td>
<td>28.31</td>
<td>5.69</td>
<td>32.86</td>
<td>6.51</td>
<td>31.00</td>
</tr>
<tr>
<td>Difficult Child (DC)</td>
<td>32.31</td>
<td>7.09</td>
<td>38.43</td>
<td>7.66</td>
<td>35.74</td>
</tr>
<tr>
<td>Parenting Stress</td>
<td>94.63</td>
<td>16.95</td>
<td>108.05</td>
<td>20.00</td>
<td>101.05</td>
</tr>
</tbody>
</table>

* p<.05

**Parenting Stress in the Mothers by the Gender of the Preschoolers with Disabilities**: The parenting stress of the mothers by the gender of the preschoolers with disabilities is shown in Table 5. Out of the subareas of parenting stress, the mothers with the male preschoolers were more stressed than the mothers with the female ones on account of parental distress and parent-child relationship, but there were no significant differences according to the children’s gender. The mothers with the female preschoolers were more stressed due to difficult child than the mothers with the male ones, but the difference was not statistically significant. This corresponds to the findings of the other studies.

Table 5. Parenting stress in the mothers by the gender of the preschoolers with disabilities

<table>
<thead>
<tr>
<th>Classification</th>
<th>Male (N=49)</th>
<th>Female (N=23)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Parental Distress (PD)</td>
<td>36.00</td>
<td>8.10</td>
<td>32.52</td>
<td>6.62</td>
</tr>
<tr>
<td>Parent-Child Dysfunctional Interaction (P-CDI)</td>
<td>30.57</td>
<td>6.53</td>
<td>29.87</td>
<td>5.00</td>
</tr>
<tr>
<td>Difficult Child (DC)</td>
<td>34.59</td>
<td>8.18</td>
<td>35.87</td>
<td>8.79</td>
</tr>
<tr>
<td>Parenting Stress</td>
<td>101.16</td>
<td>19.34</td>
<td>98.26</td>
<td>17.87</td>
</tr>
</tbody>
</table>
Parenting Stress in the Mothers by the Type of Disabilities: The parenting stress of the mothers by the children’s type of disabilities is shown in Table 6. Out of the subareas of parenting stress, parental distress was severest among the mothers who had the children with autistic disorders, but there were no significant differences according to the type of disabilities. Stress caused by parent-child relationship (F=7.10, p<.01) and by difficult child (F=5.67, p<.01) were heaviest among the mothers who had the children with autistic disorders, and the differences were statistically significant. As these findings coincides with the findings of studies\textsuperscript{12}, it can be said that the parenting stress of mothers vary with the type of disabilities.

Table 6. Parenting stress in the mothers by the type of disabilities of the preschoolers with disabilities

<table>
<thead>
<tr>
<th>Classification</th>
<th>Autism (N=27)</th>
<th>Intellectual Disabilities (N=29)</th>
<th>Others (N=16)</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Parental Distress(PD)</td>
<td>37.37</td>
<td>8.29</td>
<td>33.48</td>
<td>8.15</td>
<td>33.25</td>
</tr>
<tr>
<td>Parent-Child Dysfunctional Interaction(P-CDI)</td>
<td>33.00</td>
<td>6.13</td>
<td>30.07</td>
<td>5.46</td>
<td>26.38</td>
</tr>
<tr>
<td>Difficult Child(DC)</td>
<td>38.93</td>
<td>8.66</td>
<td>32.03</td>
<td>5.92</td>
<td>33.75</td>
</tr>
<tr>
<td>Parenting Stress</td>
<td>109.30</td>
<td>21.46</td>
<td>95.59</td>
<td>14.40</td>
<td>93.38</td>
</tr>
</tbody>
</table>

** p<.01

The Correlations among Parental Distress, Parent-Child Relationship, Child Temperament and Parenting Stress

The correlations among parental distress, parent-child relationship, child temperament and parenting stress are shown in Table 7. Parental distress had a statistically significant positive correlation with parent-child relationship (r=.569, p<.001), difficult child (r=.533, p<.001) and parenting stress (r=.833, p<.001). Accordingly, it’s found that the mothers of the preschoolers with disabilities experienced more stress caused by parent-child relationship and difficult child and more parenting stress when their parental distress was severer.

Parent-child relationship had a statistically significant positive correlation with difficult child (r=.635, p<.001) and parenting stress (r=.839, p<.001). Therefore it’s found that the mothers of the preschoolers with disabilities underwent more stress caused by difficult child and parenting stress when their stress caused by parent-child relationship was heavier.

Table 7. The correlations among parental distress, parent-child relationship, child temperament and parenting stress

<table>
<thead>
<tr>
<th>Classification</th>
<th>PD</th>
<th>P-CDI</th>
<th>DC</th>
<th>PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental Distress(PD)</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent-Child Dysfunctional Interaction(P-CDI)</td>
<td>0.569*** (0.000)</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult Child(DC)</td>
<td>0.533*** (0.000)</td>
<td>0.635*** (0.000)</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Parenting Stress(PS)</td>
<td>0.833*** (0.000)</td>
<td>0.839*** (0.000)</td>
<td>0.868*** (0.000)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*** p<.001
Difficult child had a statistically significant positive correlation with parenting stress ($r=.868$, $p<.001$). So it’s found that the mothers of the preschoolers with disabilities suffered from more parenting stress when they were more stressed out because of their difficult children. Parental distress was positively correlated with parent-child relationship, difficult child and parenting stress, and the parenting stress of the mothers whose children were difficult was heavier. This lends credibility to the parenting stress model of study. Also found that parents show more negative parenting attitudes to their children when their parenting stress is heavier, and the finding of this study also corresponds to that of study that more parenting stress leads to lower parenting efficacy.

**Conclusion**

The birth of a child with disability brings about lots of psychological and realistic problems to his or her parents, and that may result in detracting from the quality of life of the parents. Especially, the mother who is the main caregiver experiences stress over parenting. Lately, the relevant law has been reinforced, and support is provided for families of preschoolers with disabilities at a national level. In fact, however, raising children with disabilities is still a great pain for parents. In this study, Korean Parenting Stress Index (K-psi) was used to research the parenting stress of the mothers who had children with intellectual disabilities and autistic disorders, and the following conclusion was reached:

First, the parenting stress of the mothers of the preschool children with disabilities was heavier than that in other studies. They scored high on all the three subitems of the parenting stress index, which were parental distress, difficult child and parent-child dysfunctional relationship. As for the results by the characteristics of the children, the mothers were more stressed out when their children were at the age of five rather than the age of four, and when their children had autistic disorders rather than intellectual disabilities, but there were no significant differences according to their gender. Accordingly, the support system geared toward mothers of preschool children with disabilities should be more strengthened. Specifically, they should be helped to learn the ways of parenting tailored to the type of disabilities, because mothers who have children with autistic disorders experience more parenting stress on account of the children’s difficult temperament. How both full-fledged formal and informal family support can be provided for mothers of preschool children with disabilities should carefully be devised.

Second, there were positive correlations among parental distress, difficult child temperament, parent-child dysfunctional interaction and parenting stress. It implies that the mothers underwent pain due to their children’s disabilities, and that it resulted in making parent-child interactions dysfunctional. Ultimately, parent-child dysfunctional relationship undermines children’s development and consequently increases the pain of their parents, which poses a threat to the mental health of mothers. Since the mental health of mothers is instrumental in the happiness and sound functions of their families, professional counseling should be provided for them. Currently, welfare centers for people with disabilities and special education institutions mainly offer counseling for parents. In special education institutions, however, teachers are mostly responsible for that, and there are lots of limits to their counseling because they can counsel them only about how to educate children with disabilities. So assistance from professional counselors who can take care of the mental health of mothers of children with disabilities is required. Counselors or itinerant counselors should be assigned to cooperate with teachers to support these mothers in special education institutions, and when the mothers want to receive counseling from a professional institution, necessary financial aid should be offered so that they could be conscious of their own stress and become more active in solving their problems.

**Ethical Clearance** - Not required

**Source of Funding** - This study was supported by 2018 Research Grant from Baekseok University.

**Conflict of Interest** - Nil

**References**


2. Park MS, Kim JE. A Causal study of parenting efficacy based on the effect of parental resources and parenting stress in low income family. Korean


Effect of an Exercise Program Using a Foam Roller on Shoulder Height and Muscle Activity in Adults in their Twenties with Round Shoulder

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Department of Physical Therapy, Namseoul University, 31020 Korea

Abstract

Background/Objectives: This study aimed to investigate the effects of an exercise program using a foam roller on shoulder height and pectoralis major and upper trapezius muscle activities in adults in their twenties with round shoulders.

Methods/Statistical analysis: The study participants were randomly assigned to a foam roller (n=10) or home exercise group (n=10). The exercise program was performed three times a week for 4 weeks. The foam roller exercise group performed both the foam roller and home exercises, while the home exercise group performed only the home exercise program. Shoulder height and pectoralis major and upper trapezius muscle activities were measured before and after intervention.

Findings: In the within-group comparison, the foam roller group showed significant decreases in upper trapezius muscle activity (p<.05) and shoulder height (p<.05), but no significant change in pectoralis major muscle activity (p>.05). The home exercise group showed no significant differences in muscle activity or shoulder height between the pre- and post-intervention measurements (p>.05). In the between-group comparison, no significant difference in muscle activity or shoulder height was found between the foam roller and home exercise groups (p>.05).

Improvements/Applications: The 4-week foam roller exercise program is an effective exercise method for correcting round shoulder.

Keywords: Round shoulder, Foam roller, Home exercise

Introduction

Sitting and working for a long time increases muscle fatigue in the back muscles and makes maintaining correct body alignment difficult[1]. Likewise, the use of computers and smartphones for a long time can cause postural deformity, and neck and shoulder pain[2]. The round shoulder posture is characterized by anterior protrusion of the acromion relative to the gravity line of the body and scapular elevation. This increases the anterior curvature of the lower cervical vertebra and the backward curvature of the upper spine, placing the scapulae in a protracted, downward rotated, anteriorly tilted position[3]. This increases tension and stress in the neck and shoulder muscles, leading to a deficit in upward rotation of the scapulae and causing shoulder pain and impaired function[3-5].

Lau et al reported that a round shoulder posture makes normal shoulder movement difficult[6]. Maintaining this incorrect posture continually causes upper crossed syndrome, which is associated with weakening of the rhomboids, serratus anterior, and lower trapezius and shortening of the pectoralis major, pectoralis minor, upper trapezius, and levator scapulae. This causes muscle imbalance, which in turn results in musculoskeletal pain[7]. The clinical features of round shoulder due to poor posture include shortening of the pectoralis major

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and pectoralis minor, shortening of the upper trapezius, and weakening of the lower trapezius and serratus anterior due to low frequency of use. Jason [7] reported that the pectoralis major is shortened in round shoulder, and Lau et al [6] found that white-collar workers with neck and shoulder pain showed forward head posture, anterior round shoulder posture, and inappropriate muscle activity in the upper trapezius. Various studies have been conducted to correct round shoulders, and intervention methods include the McKenzie exercise, Kendall exercise, stretching, muscle-strengthening exercise, scapular posterior tilt exercises, shoulder orthosis, soft tissue activation, Kinesio taping, stability ball exercises, and foam roller exercises. Several reports have described the effects of these exercises [8-12].

Foam rollers are a common intervention method used by rehabilitation specialists to massage the tissues of patients and customers. Previous studies established the positive effects of foam rolling on muscle tension [13] and reported that foam rolling affects muscle elasticity, thus increasing the mobility of joints in various body parts [14].

As such, foam rollers can be used for muscle relaxation, and their effects are being studied. The purpose of this study was to investigate the effects of foam rollers, which have recently been used often in exercise programs, on the shoulder height and pectoralis major and upper trapezius muscle activities of adults in their twenties with round shoulders.

**Materials and Method**

**Study design**

Independent variables are foam roller exercise and home exercise. Dependent variables are measurements of shoulder height and muscle activity. Study design is collective design.

**Subjects**

In this study, 20 university students in their twenties were recruited from N University in Cheonan city and assigned, 10 persons each, to a foam roller exercise (FR) group or a home exercise program (HP) group. The subjects were selected on the basis of with the following criteria [10,15]: individuals in whom, when lying supine on a table, the height of the acromion from the table was at least 2.5 cm; individuals without shoulder pain or abnormal conditions; individuals with no history of shoulder surgery; individuals with no neurological symptoms; individuals without heart conditions; and individuals who were not taking any medication that can alter muscle function. The study purpose and the methods were explained to all participants, who provided written informed consent as defined by the Declaration of Helsinki before participating. The general characteristics of the subjects are as follows. FR group is 23.4±1.95 yr, 170.4±11.6 cm, 79.41±25.6 kg, HP group is 20.5±0.8 yr, 167.4±11.33 cm, 61.79±10.63 kg.

**Research Method**

In this study, we recruited 20 university students in their twenties who were attending N University in Cheonan city, assigned 10 persons each to the FR and HP groups, and performed measurements before and after the students participated in the 4-week exercise program (Table 1,2).

**Table 1. Foam roller exercise Protocol**

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Contents</th>
<th>Set</th>
</tr>
</thead>
</table>
| Relaxes exercise of neck muscles | 1. Hold left for 3 sec in neutral position.  
2. Rotate right and hold for 3 seconds. | 8 time (per 10sec) x 2set |
| Upper thoracic exercise | 1.Roll the foam roller 5 seconds above and below the scapula | 80 time (per 10sec) x 2set |
| Thoracic and Rhomboid exercise | 1.Place the foam roller in the middle of the scapula.  
2.Tilt the head and shoulders to the bottom for 5 seconds. | 80 time (per 10sec) x 2set |
| Pectoralis major stretching exercise 1 | 1.Place the spine alignment and lie on the foam roller.  
2.Side to side in the bottom, the pectoralis major are stretched. | 8 time x 2set |
| Pectoralis major stretching exercise 2 | 1.Place the spine alignment and lie on the foam roller  
2.Arrange the arms side by side, rotate the arm in the posture. | 8 time x 2set |
| Serratus anterior exercise 1 | 1.Place the spine alignment and lie on the foam roller.  
2.Keep the posture side by side, and protract out the scapula | Left and right 6 side time x 2set |
| Serratus anterior exercise 2 | 1. Hold the foam roller forward.  
2. One arm holds the floor, the other arms protraction | Left and right 6 side time x 2set |
### Table 2. Home exercise program Protocol

<table>
<thead>
<tr>
<th>Target structure</th>
<th>Exercise</th>
<th>Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pectoralis major</td>
<td>1. Stand on a cornered wall and attach your arms to the wall with crust.</td>
<td>1min (per 20s) x 3set</td>
</tr>
<tr>
<td>stretching exercise</td>
<td>2. Push forward.</td>
<td></td>
</tr>
<tr>
<td>Scapula Stabilization exercise</td>
<td>1. A modified form of push-up motion keeps the scapula in the center.</td>
<td>1min (per 20s) x 3set</td>
</tr>
<tr>
<td>Lumbar exercise</td>
<td>2. Return to original posture.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Bend one leg at 90° and fix the lower waist.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Turn the arm of the bent leg to the opposite side and hand it over</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Gze is sent to the passing side.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2min (per 30s) x 2set</td>
<td></td>
</tr>
<tr>
<td>Thoracic strength</td>
<td>1. Put a towel on the pole and stretch your arms.</td>
<td>5min (20 time) x 3set</td>
</tr>
<tr>
<td>exercise</td>
<td>2. As breathe out, pull towel and drag</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Beathe in and slowly come back to posture.</td>
<td></td>
</tr>
</tbody>
</table>

A body composition analyzer (Inbody 720, Biospace, Korea) was used to evaluate the general characteristics of the study subjects. Shoulder height was measured using vernier calipers (Corn, China). After having the subject lie comfortably supine on a table, with both arms in a neutral position, two examiners measured the distance between the subject’s acromion and the table surface using a vernier caliper\(^{[16]}\). Eight-channel electromyography was used to measure the muscle activity of the pectoralis major and upper trapezius. The electromyography sampling rate was set to 1000 Hz, the frequency band was set to 20–500 Hz, and the notch filter was set to 120 Hz. The root mean square (RMS) of the electromyography (EMG) signals was calculated. Surface electromyography electrodes (Ag/AgCl Monitoring Electrode 2225, 3M, Korea) were used, and the electrodes were attached to the muscle after rubbing the area with an alcohol swab. Maximal isometric contraction (MVIC) was measured beforehand by using manual muscle tests. In the MVIC measurement, muscle activity was measured three times for 5 seconds each. The RMS value of the 3-second interval, excluding the first and the last seconds, was obtained. The EMG electrodes were attached slightly medially between the spinous process of C7 and the acromion for the upper trapezius and 2 cm medial to the axillary fold for the pectoralis major\(^{[17]}\).

In this study, 20 university students in their twenties were assigned 10 persons each to the FR and HP groups and, after pre-intervention measurements were taken, participated in an exercise program 3 times a week for 4 weeks. The FR group performed both the foam roller and home exercise programs, while the HP group only performed the home exercise program. The exercise programs were developed by modifying the exercise programs of Pavlu and Novosadova\(^{[18]}\), Wong et al\(^{[10]}\), and MacDonald et al\(^{[13]}\).

**Statistical analysis**

The statistical analysis program SPSS version 20.0 was used for data analysis in this study. The normality of the distribution was verified using the K-S test. The extent of round shoulder according to the type of exercise was analyzed using a T test (independent t test). Paired T tests were used to determine the difference in shoulder height and pectoralis major and upper trapezius muscle activities by time point (pre- and post-intervention). The statistical significance level was \( \alpha = .05 \).

**Results and Discussion**

When we compared the pre-and post-exercise
measurements in the FR group, the upper trapezius muscle activity and shoulder height decreased significantly <Table 3>. No significant differences in muscle activity and shoulder height were found when the pre- and post-intervention differences were compared between the two groups <Table 4>.

Table 3. Within-group comparison of pre- and post-intervention muscle activities and shoulder height in the FR and HP groups.

<table>
<thead>
<tr>
<th></th>
<th>FR (n=10)</th>
<th>p</th>
<th>HP (n=10)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre (M±SD)</td>
<td></td>
<td>post (M±SD)</td>
<td></td>
</tr>
<tr>
<td>Pectoralis major</td>
<td>99.64±9.61</td>
<td>.81</td>
<td>94.58(±9.65)</td>
<td>.09</td>
</tr>
<tr>
<td>Upper trapezius</td>
<td>105.95±8.36</td>
<td>.03*</td>
<td>110.99(±15.82)</td>
<td>.33</td>
</tr>
<tr>
<td>Shoulder height</td>
<td>7.30±1.16</td>
<td>.00*</td>
<td>6.78(±2.49)</td>
<td>.13</td>
</tr>
</tbody>
</table>

*Expressed as p<0.05, FR: foam roller exercise, HP: home exercise program.

Table 4. Between-group comparison of pre- and post-intervention muscle activities and shoulder height in the FR and HP groups

<table>
<thead>
<tr>
<th></th>
<th>FR (n=10)</th>
<th>HP (n=10)</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>post-pre (M±SD)</td>
<td>post-pre (M±SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pectoralis major</td>
<td>-8.2±10.59</td>
<td>10.55±16.29</td>
<td>-1.82</td>
<td>.09</td>
</tr>
<tr>
<td>Upper trapezius</td>
<td>-8.07±10.29</td>
<td>6.36±18.21</td>
<td>-2.10</td>
<td>.06</td>
</tr>
<tr>
<td>Shoulder height</td>
<td>-1.90±.88</td>
<td>-1.11±1.96</td>
<td>-1.15</td>
<td>.27</td>
</tr>
</tbody>
</table>

*Expressed as p<0.05, FR: foam roller exercise, HP: home exercise program.

This study aimed to examine the effects of an exercise program using foam rollers on muscle activity and shoulder height in adults in their twenties who had round shoulders.

The comparison of pre- and post-intervention measurements within the FR group showed a significant reduction in upper trapezius activity. This suggests that applying foam roller exercises to a tight upper trapezius muscle, which causes round shoulders, can produce changes in the properties and tension of the muscle tissue. As such, applying mechanical stress, heat, massage, or pressure to the fascia allows for greater flexibility with a wider joint range of motion. During foam roller exercise, the shape of the pressure exerted by an individual’s body weight generates a relatively large mechanical stress on the muscles[19]. Moreover, previous studies found decreases in H-reflex amplitude and spinal motoneuron excitation after massage. The magnitude of H-reflex was reliant on massage pressure, and deep massage promoted inhibition of spinal motoneurons; the involvement of deep mechanoreceptors may have reduced the H-reflex.[20-22]. In a study by Markovic[19], when a foam roller was applied to soccer players’ quadriceps and hamstrings, it immediately produced a significant increase in the range of motion of the knee and hip joints. The increased range of motion of the knee and hip joints after foam roller use is considered to have been caused by combination of frictional effects, fascia relaxation, and neuro-inhibitory mechanisms. Further
research is needed to define mechanisms that support this increased range of motion. Therefore, during foam roller exercises, the direct pressure applied to the tight trapezius muscles, which cause round shoulder, led to changes in the muscle tissue, while neuro-inhibitory mechanisms also altered tension control, resulting in decreased muscle activity.

On the other hand, Kwon et al\cite{23} reported that head position can have various effects on head/shoulder kinetics and muscle activity, and recovery of normal function in the upper trapezius and anterior serratus counts as an important factor in correcting forward head posture and round shoulder. In their study, they measured the activity of various muscles after dividing subjects with forward head posture and round shoulder into three groups, with different seated postures. The muscle activities of the upper trapezius and anterior serratus were significantly decreased in the group that received posture correction by a therapist. These results show that even short-term posture correction can affect muscle activity. In our study, the subjects’ postures were corrected after 4 weeks of foam roller exercise, which is thought to have caused a reduction in upper trapezius activity.

In the present study, no significant difference was found in the muscle activity of the pectoralis major. This may be due to the fact that unlike the upper trapezius, the pectoralis major did not receive direct pressure from the foam roller during foam roller exercises and only a stretching action was applied. In this study, we investigated the muscle activity of the pectoralis major, unlike previous studies that investigated the pectoralis minor in relation to round shoulder\cite{10,11,24}. Therefore, difference in the effects of the pectoralis major and pectoralis minor on round shoulder requires further study.

In this study, when pre- and post-intervention shoulder heights were compared within the foam roller group, we observed a significant decrease. Ruivo et al.\cite{25} suggested that forward head posture and round shoulder can be corrected by improving the extension ability of the muscle groups that restrict joint range of motion and thereby restoring the normal muscle balance between the agonist and antagonist muscle. Ruvio et al reported that stretching and muscle strengthening exercises reduced the degree of round shoulder, consistent with the results of the present study. In this study, we found a significant decrease in upper trapezius activity in the foam roller group when we compared pre- and post-exercise measurements. This change in the muscle seems to have also affected the reduction in shoulder height.

We did not observe any significant differences in shoulder height and muscle activity within the home exercise group. Lee et al.\cite{26} applied McKenzie and Kendall exercises and self-stretching for 8 weeks in the subjects with forward head posture and round shoulder, and Ruivo et al. (25) applied a resistance training and stretching program for 32 weeks in adolescents with forward head posture and round shoulder.

The limitations of this study are as follows: The results of this study are difficult to generalize to all people with round shoulder because the subjects were adults in their twenties. In addition, the long-term effectiveness is unknown because measurements were only taken before and after the 4-week exercise intervention. As such, future studies should investigate round shoulder in various age groups and examine the persistence of the effects of foam roller exercises.

**Conclusion**

The purpose of this study was to investigate the effects of an exercise program using a foam roller on shoulder height and pectoralis major and upper trapezius muscle activities in adults in their twenties with round shoulders. In the within-group comparison, the foam roller group showed significant decreases in upper trapezius muscle activity and shoulder height.

In our study, the duration of the exercise intervention was set at 4 weeks. In particular, the duration of the home exercise program was shorter than the foam roller exercise program, and we believe that this duration was not sufficient to induce changes in muscle activity and shoulder height.

**Ethical Clearance** - Not required

**Source of Funding** - Funding for this paper was provided by Namseoul University

**Conflict of Interest** – Nil

**References**


A Comparison of Taste of Drinking Water for Water Purifier Filter Development

Kyung-Hee Lee¹, Soo-Yong Park², Eun-Hyeon Jo³, Dong-Hyung Lee⁴

¹Research Scholar, ²Research Scholar, ³Research Scholar, ⁴Professor, Department of Industrial & Management Engineering, Hanbat National University, Dongseo-daero, Yuseong-gu, Daejeon, Korea

Abstract

Background/Objectives: The competitiveness of water purifier products is dependent on the taste of water preferred by consumers. Therefore, this study was carried out to compare and analyze the taste of drinkable spring water and purified water, with the aim of using the data in developing a water purifier filter that would satisfy the water taste.

Methods/Statistical analysis: In this study, 22 students from H University drank three types of drinkable spring water, which were designated A, B and C, and purified water, D, and compared the sensory stimuli. In order to examine the preferences and differences based on the sense of taste, the stimuli were paired for one-to-one comparisons. The analysis results were expressed on a yardstick for easy interpretation.

Findings: As a result of carrying out the experiment based on the paired comparison method to examine water taste preferences using four stimuli, which were three products of drinkable spring water from different sources and one type of purified water from a water purifier manufactured by company K, there was a significant difference among the stimuli. Also, the results of comparing the individual taste of water based on a taste-based sensory evaluation (evaluated tastes: sweetness, saltiness, bitterness and sourness) showed that the stimuli were ranked as A, C, B and D in the order of most sweet to least sweet and as A, B, C and D in the order of most bitter to least bitter. On the other hand, there were no significant differences in sourness or saltiness.

There were also differences in the mineral content of the drinkable spring water used as the stimuli of this experiment. When the mineral content and the sensory test results were compared, it was found that high calcium content corresponded with a high level of sweetness and high magnesium content corresponded with a high level of bitterness.

Improvements/Applications: The taste of purified water was inferior to that of drinkable spring water, and in order for company K to boost the competitiveness of its water purifier in the market, improving the taste of the purified water is the most urgent issue at hand.

Keywords: water purifier, water purifier filter, drinkable spring water, water taste, bottled water, paired comparison method

Introduction

As a result of the rapid industrial growth and environmental changes, water consumption has increased and the severity of water pollution has reached serious levels in recent years in Korea. Although the government is providing tap water that has been treated at purification facilities as drinking water, a growing number of people purchase drinkable spring water or use water purifiers due to safety concerns of tap water arising from their interest in health that has been driven by higher living standards¹,²

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Recently, water purifiers have become an essential tool for obtaining clean drinking water, with the penetration of water purifiers into public facilities and homes. The standards with which people choose a water purifier product include price, brand image, performance and the taste of purified water among other factors. Companies have been endeavoring to expand the market by advertising their new water purifier models as upgraded in performance or based on strategic image marketing, but the actual improvement of the water palatability has relatively been marginal. Humans have gustatory cells, with which they can sense the taste of water, and the taste of water varies depending on its mineral content. Of particular note, the taste of purified water differs according to the type of filter used in the water purifier and the filtration method applied. Considering that the taste of water is an important factor for consumers when choosing a water purifier, developing a filter for improved water palatability is an urgent task for boosting the competitiveness of water purifiers in the market.

Accordingly, this study was conducted to examine the preferences in relation to the taste of three types of drinkable spring water with high sales in the market and the taste of purified water obtained from a water purifier manufactured by company K as well as the differences in the sensory evaluation (evaluated tastes: sweetness, saltiness, bitterness and sourness) using the paired comparison method and to utilize the findings in developing a water purifier filter.

Background

**Drinkable Spring Water**

The types of drinking water available in Korea can be categorized into tap water, drinkable spring water, groundwater and purified water. The term, “drinkable spring water,” refers to a type of bottled spring water that has been called “preserved potable water” and “potable spring water” before being renamed as “drinkable spring water” in December 1994. In Korea, the business of producing and selling drinkable spring water is prescribed as an approved business category. With the Management of Drinking Water Act coming into effect on May 1, 1995, drinkable spring water has been one of the major types of drinking water consumed. There are around 70 spring water manufacturers with 100 different brands in Korea, and more recently, there has been an emergence of spring water experts who call themselves “water sommeliers.”

**Water Purifiers**

Most water purifiers basically consist of four stages of filtration: the first is a sediment filter, which removes relatively large suspended solids in water; the second is a pre-carbon filter, which removes volatile organic compounds (VOCs); the third is a membrane filter, which removes pollutants, bacteria, viruses, and iconic substances including heavy metals; and the fourth is a post-carbon filter, which is made of silver-coated activated carbon, and it enhances the antimicrobial performance and eliminates any foul odor of water. Among these, it is the membrane filter, involved in the third stage of filtration, that is the key filter, and membrane filters can be divided into the reverse osmosis (R/O) type and the ultrafiltration (UF) type.

The R/O membrane filter causes the water to move in the opposite direction of osmosis, which is a phenomenon in which water moves from a low concentration of solutes to a high concentration of solutes. This involves applying pressure to a liquid with a high concentration of solutes to push the water molecules to the area with low concentration of areas through several layers of microfilms. The downside is that the microfilm layer filters out not only bacteria, viruses, various impurities, heavy metals, carcinogens and radioactive substances, but also beneficial minerals, and that all the water that did not pass through the filter due to the process of reverse osmosis gets discarded.

The UF membrane filter is a type of filter that has been developed to use the filtration performance of artificial kidneys. “Hollow fibers,” which are a type of very thin thread measuring 0.1 micron in diameter, are connected together to form tiny holes that are around 0.01~0.04 microns in size. Unlike the R/O type, the UF membrane filter does not remove any minerals and lets them pass through. Thus, the resulting purified water retains abundant minerals, and this is why water purifiers equipped with a UF membrane filter is preferred by consumers. The downside, however, is that it cannot filter out heavy metals and radioactive substances.

**Materials and Method**

Previous studies have generally described the relationship between drinkable spring water and
consumers. However, there has been a limited amount of empirical research on the actual taste of water. Accordingly, this study was carried out to compare and analyze the preferences of four sensory stimuli, which were three products of drinkable spring water obtained from different sources and one type of purified water from a water purifier manufactured by company K, and to examine the differences in the water taste sensed by the taste sense (sweetness, saltiness, sourness and bitterness). For this purpose, the following research tasks were designated for the experiment.

1. Perform an inter-comparison of the water taste preferences among the stimuli.
2. Perform an inter-comparison of the intensity of the taste sensations of the stimuli.
   2.1 Perform an inter-comparison of the intensity of the sweetness tasted from the stimuli.
   2.2 Perform an inter-comparison of the intensity of the sweetness tasted from the stimuli.
   2.3 Perform an inter-comparison of the intensity of the sourness tasted from the stimuli.
   2.4 Perform an inter-comparison of the intensity of the saltiness tasted from the stimuli.

The subjects in the experiment carried out for this project were 22 students from H University. In order to ensure the accuracy of the experiment, the subjects were asked to avoid alcohol, smoking and irritating foods and regulate their sleep for three days before the experiment. In the experiment, the subjects compared the taste of the three products of drinkable spring water obtained from different sources and the purified water from a water purifier manufactured by company K, as shown in Table 1, and the order in which the samples were presented was randomly assigned based on a table of random sampling numbers. During the experiment, the subjects rinsed their mouths with distilled water before and after tasting each sample in order to eliminate the any residual stimuli inside the mouth. The collected data were analyzed using the paired comparison method. The paired comparison method involves pairing stimuli for comparison and ranking them. This method is used to judge how one stimulus compares with another stimulus based on a specified scale. For instance, a pair of stimuli is presented, and the subject must indicate how one stimulus compares with the other stimulus. In this particular study, the taste of water was measured on a 7-point scale (“Very Bad (-3 points),” “Bad (-2 points),” “Slightly bad (-1 point),” “Average (0 points),” “Slightly good (1 point),” “Good (2 points),” and “Very good (3 points)”). Using the collected data, the stimuli were ranked based on the scale, and the significant difference in relation to the rankings was tested[13,14].

<table>
<thead>
<tr>
<th>Drinkable spring water A (Glacial sedimentary groundwater)</th>
<th>Drinkable spring water B (Volcanic rock)</th>
<th>Drinkable spring water C (Half of granite)</th>
<th>Purified Water D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral content(mg/L): Ca(54.0–87.0), Mg++(20.3–26.4), Na++ (4.4–15.6), K+(1.0–1.3), F-(0–0.1)</td>
<td>Mineral content(mg/L): Ca(2.2–3.6), Mg++(1.0–2.8), Na++ (4.0–7.2), K+(1.5–3.4)</td>
<td>Mineral content(mg/L): Ca(12.2–18.4), Mg++(1.7–2.6), Na++ (6.2–9.3), K+(0.4–0.7), F-(0–0.1)</td>
<td>Apply hollow fiber filter</td>
</tr>
</tbody>
</table>

Table 1: Characteristics of stimuli

The procedure of the experiment was as follows:

1. The subjects tilted the water sample at 45° and viewed it against a white piece of paper (A4 size) as the background to check for any suspended matter and examine the degree of clarity, and smelled the water to check for any abnormal smell.
2. As for the taste-based sensory evaluation, four stimuli (A, B, C and D), consisting of drinkable
spring water and purified water measuring 20–22°
in temperature, were prepared. The subjects held the
samples inside their mouths for more than 4 seconds,
during which they rolled their tongues. Then, they sipped
on the water to evaluate its taste.

3. Between the tastings of the samples, the subjects
rinsed their mouths with distilled water to prevent
residual water from remaining inside the mouth and
affecting the result of the following test.

Results

The experiment was carried out using the paired

Table 2: Comparison of the stimuli (*P<0.05, **P<0.01)

<table>
<thead>
<tr>
<th></th>
<th>Significance level: 1%</th>
<th>Significance level: 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range between B and C</td>
<td>0.466 &lt; 0.483</td>
<td>0.466 &gt; 0.396</td>
</tr>
<tr>
<td>Range between C and A</td>
<td>0.494 &gt; 0.483</td>
<td>** 0.494 &gt; 0.396</td>
</tr>
<tr>
<td>Range between A and D</td>
<td>0.432 &lt; 0.483</td>
<td>0.432 &gt; 0.396</td>
</tr>
</tbody>
</table>

Figure 1. Location on the Yard Stick

Based on the results of the paired comparison test
on sweetness, the differences were acknowledged at a
significance level of 1% and 5%. As shown in <Table 3>
and <Figure 2>, the results of the yardstick-based test
were 0.631 for A, -0.176 for B, 0.216 for C, and -0.670
for D (purified water). In other words, A was found to be
the sweetest, whereas there was not much difference in
terms of sweetness between C and B. Also, the subjects
were not able to taste any sweetness from B and D at a
significance level of 1%.

Table 3: Comparison of the stimuli (*P<0.05, **P<0.01)

<table>
<thead>
<tr>
<th></th>
<th>Significance level: 1%</th>
<th>Significance level: 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range between B and C</td>
<td>0.415 &lt; 0.483</td>
<td>0.415 &gt; 0.396</td>
</tr>
<tr>
<td>Range between C and A</td>
<td>0.398 &lt; 0.483</td>
<td>** 0.392 &lt; 0.396</td>
</tr>
<tr>
<td>Range between A and D</td>
<td>0.523 &gt; 0.483</td>
<td>** 0.432 &gt; 0.396</td>
</tr>
</tbody>
</table>

Figure 2. Location on the Yard Stick

Based on the results of the paired comparison
experiment on bitterness, the differences between the
samples were acknowledged at a significance level of
1% and 5%. As shown in <table 4> and <Figure 3>,
the results of the yardstick-based test were 0.722 for A,
0.023 for B, -0.091 for C, and -0.653 for D. In other
words, A was found to be the most bitter, and there was
a significance difference in the bitterness of A and B at a significance level of 1%. Similar to the results on sweetness, there was not much difference in the bitterness tasted from B and C, whereas there was a difference between C and D at a significance level of 1%. On the other hand, there were no significant differences found in relation to saltiness and sourness.

**Table 4: Comparison of the stimuli (\(*P<0.05, \quad **P<0.01)\)**

<table>
<thead>
<tr>
<th>Significance level: 1%</th>
<th>Significance level: 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range between B and C</td>
<td>0.699 &gt; 0.483 **</td>
</tr>
<tr>
<td></td>
<td>0.699 &gt; 0.396</td>
</tr>
<tr>
<td>Range between C and A</td>
<td>0.114 &lt; 0.483</td>
</tr>
<tr>
<td></td>
<td>0.114 &lt; 0.396</td>
</tr>
<tr>
<td>Range between A and D</td>
<td>0.563 &gt; 0.483 **</td>
</tr>
<tr>
<td></td>
<td>0.563 &gt; 0.396</td>
</tr>
</tbody>
</table>

**Figure 3. Location on the Yard Stick**

**Discussion**

Based on the results of each research task, it was found that the level of sweetness was the highest for Sample A, followed by C and B, with D (purified water) coming last. From <Table 1>, it can be inferred that there is a positive correlation between the calcium content and the level of sweetness. As for the rankings in bitterness, it was A, B, C, and D in the order of least bitter to most bitter. Based on <Table 1>, it can be seen that the magnesium content has an effect on bitterness. As for saltiness and sourness, the differences between the drinkable spring water samples and the purified water sample were difficult to distinguish.

As shown in the results of the preference test in <Table 2>, Sample B had the highest ranking, whereas Sample A had both sweetness and bitterness due to the high mineral content, but ranked third in the preference test, which was deemed relatively low. This shows that water does not necessarily taste pleasant just because it has high mineral content.

**Conclusion**

From the results of this study shown above, it could be seen that the mineral composition and content of water affect its taste and in turn the preferences of consumers. Also, the preference for the taste of purified water was found to be low in this study, and thus, in order to improve the taste of purified water, there should be consideration of a method for not removing the minerals in the filtration process or adding an appropriate amount of minerals to purified water. Accordingly, there is a need to perform follow-up research to seek measures for adding specific minerals to the four-stage filtration system comprised of a sediment filter, pre-carbon filter, membrane filter and post-carbon filter that is most commonly applied to water purifiers for the purpose of producing purified water with a taste that is preferred by consumers and allowing the users to replenish their bodies with essential minerals.

Previous studies have mostly centered on the current state of water purifiers, and there has been a considerable lack of research on the filtration system. It is necessary to continue conducting research on water purifier filters to allow consumers to drink clean and delicious water in the future.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** - Nil

**References**

4. Park SH, Lee TW. Investigation of the Preferred Taste of Water of Keimyung University Students. Journal of Nakdong River Environmental Research


Improving Satisfaction through the Analysis of Decision-Making Criteria of Meteorological Information User

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Abstract

It is important to understand how forecast information is recognized and used in order to effectively facilitate service delivery to the meteorological community. This study was conducted to quantitatively estimate users’ dissatisfaction level with forecasting errors and to evaluate whether the distribution of user’s decision criteria of probabilistic forecasts is appropriate. Correlation analysis was conducted between the satisfaction value of forecasts and the user-perceived accuracy to estimate the level of dissatisfaction regarding inaccurate forecasts. Further, satisfaction value was compared between an actual and a virtual group to investigate how forecast users are effectively utilizing the information. The analysis showed that the users who responded to the questionnaire generally did not recognize the effective probability threshold as being able to provide a better value. These users were estimated to be very dissatisfied when adverse weather was not predicted in advance. Meanwhile, the value of the forecast to younger users (19–39 years) can be increased by adjusting their current user threshold. However, those over 60 years did not benefit from this adjustment. To improve user satisfaction with forecasts, it is deemed necessary to educate users regarding the meaning of probabilistic forecasts and the probability threshold pattern based on age group. By quantitatively analyzing user dissatisfaction, it is possible to estimate which forecast elements and forecasting errors garner user dissatisfaction. Through such analysis, moreover, we can help the meteorological community to develop better services by considering the characteristics of the user group.

Keywords: perceived accuracy; probability threshold; value score; 22 model; satisfaction.

Introduction

The increase in extreme weather events due to climate change is a serious challenge for the meteorological community, which provides weather-related information. As the risk of damage to human life and property due to a hazardous weather phenomenon increases, the demand for providing accurate weather forecasts increases. However, the prediction becomes increasingly difficult because of the frequent occurrence of a local weather phenomenon. Thus, the objective of the meteorological community is to improve the accuracy of weather forecasts; however, it is difficult to continually improve accuracy levels because the accuracy of a very short-term forecast (e.g., rainfall) already exceeds 90% in Korea. Furthermore, providing weather forecast information that is statistically more accurate does not necessarily reduce damage caused by meteorological phenomena. This is because, even if the weather forecast information is provided, the damage itself cannot be prevented if the user does not make the necessary preparations. Thus, many researchers are focused on providing services to users with effective information utilization by investigating their perception of forecasts.

The perception of uncertainty inherent in deterministic forecasts for lay people or the use, value, and uncertainty of weather forecasts collected from people across the U.S. was analyzed. In particular, it is noteworthy that attempts have been made to support decision-making by not only studying the recognition of weather information users, but also their tendency to use forecasts, through a questionnaire to find the probability threshold of rainfall forecasts to change outdoor events.
into indoor activities over the weekend. Public perception of extreme weather on the Atlantic coast of Canada was surveyed. It was found that users had a low awareness of the risk of meteorological hazards. User preferences for road weather service have also been investigated. In Korea, the Korea Meteorological Administration (KMA) has been surveying reliability, satisfaction, and usefulness of their services for the general public and experts twice every year. However, a quantitative investigation of the satisfaction levels of users has not been presented in previous studies. It is important to attempt to analyze satisfaction quantitatively because the value of the forecast can vary depending on the level of user dissatisfaction.

In spite of the relatively accurate precipitation forecasts, the accuracy perceived by the general public regarding short-term forecasts provided by the KMA was as low as 63.6 points in the public survey regarding national weather services in 2017. The low accuracy perceived by users may be due to the fact that dissatisfaction with occasional forecasting errors is greater than the satisfaction with accurate forecasts. Therefore, in order to improve the perceived accuracy, it is necessary to prepare appropriate countermeasures by quantitatively analyzing the dissatisfaction with forecast errors. In this study, users’ dissatisfaction with forecast errors was estimated using the perception data of the respondents obtained by a survey and using the concept of a satisfaction value score (hereafter referred to as “sVS”). Finally, appropriate methods are suggested to improve the satisfaction levels.

Materials and Method

Decision-making criteria of forecast users: The KMA has been investigating the awareness of meteorological services twice a year for ordinary citizens and professionals over 19 years of age. The 2017 survey was conducted from June 15 to June 17, and October 13 to October 14, with 1,500 people participating in the survey. The research method is a random digit dialing (RDD) telephone interview using computer assisted telephone interviewing (CATI), and a sample is applied to the “resident registration demographics” of the Ministry of the Interior and Safety (MOIS) by applying weights reflecting the regional / gender / age distribution.

The data regarding decision-making for forecast users was used to analyze the sVS and is the result of the question, “At what forecast chance of rain you decide to prepare an umbrella?”. Figure 1 shows the distribution of the probability threshold for each age group in the first and second half of 2017. The average of probability threshold for all respondents is 53.3% in the first half and 52.6% in the second half. This means that many respondents will not carry an umbrella until the predicted probability for precipitation is at least 50%.

![Figure 1: Distribution of decision-making criteria of the general public using the precipitation probabilistic forecast in 2017](image)

Table 1: Accuracy and $F_1$-score based on the probability threshold of precipitation forecast with 24-hour lead time in Seoul in 2017

<table>
<thead>
<tr>
<th>Probability threshold</th>
<th>first half year</th>
<th>second half year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>accuracy</td>
<td>$F_1$-score</td>
</tr>
<tr>
<td>10%</td>
<td>55.8%</td>
<td>0.49</td>
</tr>
<tr>
<td>20%</td>
<td>76.2%</td>
<td>0.63</td>
</tr>
<tr>
<td>30%</td>
<td>85.1%</td>
<td>0.66</td>
</tr>
<tr>
<td>40%</td>
<td>84.0%</td>
<td>0.54</td>
</tr>
<tr>
<td>50%</td>
<td>84.0%</td>
<td>0.54</td>
</tr>
<tr>
<td>60%</td>
<td>84.0%</td>
<td>0.54</td>
</tr>
<tr>
<td>70%</td>
<td>83.4%</td>
<td>0.40</td>
</tr>
<tr>
<td>80%</td>
<td>82.3%</td>
<td>0.33</td>
</tr>
<tr>
<td>90%</td>
<td>77.9%</td>
<td>0.00</td>
</tr>
<tr>
<td>100%</td>
<td>77.9%</td>
<td>0.00</td>
</tr>
<tr>
<td>$\delta$</td>
<td>22.1%</td>
<td>33.9%</td>
</tr>
</tbody>
</table>
Figure 2: Perceived accuracy of short-term forecasts by age group in 2017

The meteorological information together with the probability threshold is the 24-hour precipitation probability forecast and observation data that is released at 05:00 in Seoul from January 1 to December 31, 2017. The source is the Combined Meteorological Information System 4 (COMIS4) of the KMA. The ratio (r) of rain during the first half and the second half of 2017 was 22.1% and 33.9%, respectively. Table 1 lists the accuracy values and F₁-score of the forecasts for each probability threshold. When the probability threshold was 30%, the accuracy and the F₁-score were the highest. The decision thresholds used by the general public are higher than 50% on average, as seen in Figure 1, while the probability threshold with high accuracy is much lower.

Figure 2 shows the results of the general public’s response, by age, to the question “How accurate you think are the short-term forecasts in the last 6 months of KMA?”. Although the accuracy of the forecast is over 80%, the perceived accuracy was less than 70 points, except for the user over 60 years old, in the second half of 2017 in Figure 2. Figures 1, 2 and Table 1, show that general forecast users do not effectively use the probability threshold that can be expected more accurate, and it can be seen that the satisfaction level when the forecast is correct and the dissatisfaction level when it is wrong are not at the same degree. The negative perception of the forecast errors is relatively large, which leads to a lower perceived accuracy than the actual forecast accuracy.

The value of the current precipitation probability forecast was evaluated by reflecting the satisfaction level and user dissatisfaction with forecasting errors was quantified by analyzing the relationship between the estimated forecast value and the users’ perceived accuracy. This was followed by an examination of how the satisfaction value can be improved when the decision criterion (probability threshold) of the current user group (with a probability threshold higher than 30%) changes.

Valuation of probability forecast: The original value score (VS) has been widely used as an analytical approach to the valuation of weather information. VS has been applied by various researchers since 1976 as a useful evaluation tool, especially for the evaluation of probabilistic forecasts. The 2 × 2 model, which is the basis of the theory, is derived from the situation in which the forecast user decides whether to perform an action to mitigate the risk between the forecast and the occurrence of the actual phenomenon, as shown in Table 2. In Table 2, H, M, FA, and CR are the frequencies of each case, and h, m, f, and r, are the relative frequencies. is the climatological frequency at which the event has occurred during the analysis period. The variables h, m, f, and r are calculated using the equations (1) to (4).

Table 2: 2 x 2 contingency table for valuation of weather forecast

<table>
<thead>
<tr>
<th>Observed adverse weather</th>
<th>Forecast adverse weather / Protective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Hit; H (h) Mitigated Loss or Satisfaction</td>
</tr>
<tr>
<td>No</td>
<td>Miss; M (m) Loss or Dissatisfaction (-A)</td>
</tr>
<tr>
<td>False Alarm; FA (f)</td>
<td>Correct Rejection; CR (r) None</td>
</tr>
<tr>
<td>Cost or Dissatisfaction (-B)</td>
<td></td>
</tr>
</tbody>
</table>

\[
h = \frac{H}{H+M+FA+CR} \quad (1)
\]

\[
m = \bar{o} \times (1 - HR) \quad (2)
\]

\[
f = (1 - \bar{o}) \times FAR \quad (3)
\]

\[
\bar{o} = \frac{H+M}{H+M+FA+CR} \quad (4)
\]

Based on the implementation of the risk hedging actions and the occurrence of actual adverse weather, it is possible to mitigate the loss caused by expected damage or the cost of taking protective action. The value of the deterministic forecast as well as the probabilistic forecast, by combining the relative operating characteristics (ROC) curve with the cost-loss model, was evaluated.
And, the 2 × 2 model was also used to expand the application to the actual situation through the N × N model or the sequential model in which iterative decision-making takes place. A cost-benefit model to maximize the utilization in commercial enterprises has also been proposed. Furthermore, the satisfaction-dissatisfaction model, which is the concept of existing research based on economic valuation, was expanded by evaluating the satisfaction value of user groups who use weather forecasts. They evaluated the satisfaction value change of the forecast according to the users’ probability threshold by modifying the conventional evaluation method of probabilistic forecasts, assuming that the users’ satisfaction affects the usability of the forecast.

The satisfaction value of the forecast for individual user (sVS) is also calculated based on Table 2. Satisfaction with a hit is set to 1 and satisfaction with correct rejection is 0, for convenient calculation. Misses and false alarms are negative values, -A, -B, because they assume that the forecast user is dissatisfied with the wrong forecast. The satisfaction value of the forecast for the individual forecast users is estimated as a generalization of satisfaction (Sf) that can be expected by making use of the present forecast information for decision-making as per equation (5), satisfaction (Spf) that can be expected when making decisions using minimal information in the absence of forecasts are evaluated as per equation (6), and satisfaction (Scr) according to the use of a perfectly accurate forecast. sVS is 1 when the forecast provided by the meteorological community is perfect, and 0 when it is equal to the accuracy of the climatological reference. If the forecast has a lower performance than the climatological reference information, it may be a negative value (-). Equations (6) to (9) are applied for obtaining each variable in equation (5).

\[
s_{s} = \frac{s_{p} - s_{cr}}{s_{pf} - s_{cr}} \tag{5}
\]

\[
s_{p} = 1 \times h - A \times m - B \times f + 0 \times r \tag{6}
\]

\[
s_{cr} = \max \left\{ 1 \times \bar{o} - B \times (1 - \bar{o}) \right\} \tag{7}
\]

\[
s_{pf} = \bar{o} \tag{8}
\]

A forecast user group is a collection of people using probabilistic forecasts as shown in Figure 1. The satisfaction value of the forecast for user group (cVS) is calculated as follows:

\[
s_{c} = \frac{s_{f} - s_{nf}}{s_{pf} - s_{nf}} \tag{9}
\]

Each member of the group makes decisions with different probability thresholds. As shown in Table 1, if the probability threshold changes, the forecast accuracy also changes. Therefore, even though the dissatisfaction with the forecasting error is the same, the sVS can be increased or decreased according to the critical threshold, which is the user’s decision criterion. This is the reason why probability threshold, which is the decision criterion of users, should be considered when evaluating the cVS. Equation (10) is used for calculating the expectation satisfaction of the forecast usage group by adding to p_i (i=10, 20, ..., 90, 100), which is the probability threshold distribution of the individual members:

\[
s'_{c} = \sum_{i=1}^{10} (1 \times h_{i} - A \times m_{i} - B \times f_{i}) \times p_{i} \tag{10}
\]

Equation (11) is another approach to the climatological reference used in equation (6), which assumes that the decision-maker predicts and behaves as if yesterday’s weather would be the same as today’s weather, if no forecast is provided. o_{t1} is the ratio of cases in which the same meteorological phenomenon occurred on t-1 and t days in equation (11). In the same way, o_{t0} is the miss rate shown in Table 3, and o_{t0} is the case of false alarm. This weather prediction method can achieve high accuracy when meteorological phenomena occur continuously.

\[
s_{nf} = (o_{t1} - A \times o_{t0} - B \times o_{t0}) \times \sum_{i=10}^{10} p_{i} \tag{11}
\]

s_{pf} is calculated in the same manner as equation (8) because, given a perfectly accurate forecast, everyone will make the same decision.

**Results and Discussion**

Figure 3 shows the change in the sVS of the 24-hour precipitation probability forecast for Seoul, Korea in 2017, and Table 3 shows the cVS results. In Figure 3 and Table 3, A and B are the users’ dissatisfaction degree with misses and false alarms, respectively.

Figure 3 shows that the precipitation probability forecast for the first half of 2017, provided a higher sVS for people with a relatively higher dissatisfaction with misses. Furthermore, it showed a high level of dissatisfaction with false alarms in the second half. In Table 1, the forecast accuracy of the first half was 85.1%,
which was slightly higher than the accuracy in the second half of 82.5%; however, the satisfaction value shown in Figure 3 is rather high in the second half. This is because the relative satisfaction level of CR is set to 0 in Table 2. Despite higher accuracy, the reason for the lower sVS in the first half was that the ‘hit’ situation was less likely to occur. In the first half and second half of 2017 are 22.1% and 33.9% respectively. Additionally, the probability threshold that a high satisfaction value can be derived from is 30-40%, regardless of combination of A and B in Figure 3. This means that the current forecast users shown in Figure 1 are not using the optimal probability threshold.

**Table 3: Satisfaction Value Score for user group (eVS) by age according to combination of A and B in 2017**

<table>
<thead>
<tr>
<th>Age</th>
<th>(A=2,B=3)</th>
<th>(A=3,B=2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First half year</td>
<td>second half year</td>
</tr>
<tr>
<td>19-29</td>
<td>0.31</td>
<td>0.36</td>
</tr>
<tr>
<td>30-39</td>
<td>0.32</td>
<td>0.34</td>
</tr>
<tr>
<td>40-49</td>
<td>0.30</td>
<td>0.35</td>
</tr>
<tr>
<td>50-59</td>
<td>0.25</td>
<td>0.32</td>
</tr>
<tr>
<td>Over 60</td>
<td>0.21</td>
<td>0.26</td>
</tr>
</tbody>
</table>

The eVS was higher for between 19 and 49 years old than it was for those over 50, as shown in Table 3. However, the perceived accuracy by those 50 years old and older is higher than it is for those between 19 and 49, as shown in Figure 2. Thus, it is difficult to accept the results of Table 3 as they are. This is because they are interpreted as showing that younger users perceive forecasts as less accurate, even though more accurate forecast is in fact provided. Figure 3 confirms that the same forecast can be evaluated with different values depending on the combination of the dissatisfaction variables A and B. It is necessary to evaluate the satisfaction value of the forecast for the group by changing the sizes of A and B.

**Table 4: Results of Collective Value Score (cVS) by age according to changes of dissatisfaction level of A and B**

| 2017 | A  | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
|------|----|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|---|---|---|
| B    | 2  | 2 | 2 | 2 | 2 | 2 | 2 | 2  | 4 | 5 | 6 | 7 | 8 | 9 | 10|
| 1st half year | 19-29 | 0.17 | 0.15 | 0.13 | 0.11 | 0.10 | 0.09 | 0.08 | 0.35 | 0.38 | 0.41 | 0.43 | 0.45 | 0.46 | 0.47|
| 30-39 | 0.18 | 0.16 | 0.14 | 0.13 | 0.11 | 0.10 | 0.10 | 0.36 | 0.39 | 0.42 | 0.44 | 0.45 | 0.47 | 0.48|
| 40-49 | 0.19 | 0.17 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.34 | 0.37 | 0.39 | 0.40 | 0.42 | 0.43 | 0.44|
| 50-59 | 0.17 | 0.16 | 0.15 | 0.14 | 0.13 | 0.12 | 0.12 | 0.28 | 0.30 | 0.31 | 0.32 | 0.33 | 0.34 | 0.35|
| Over 60 | 0.17 | 0.16 | 0.15 | 0.15 | 0.14 | 0.14 | 0.22 | 0.23 | 0.24 | 0.25 | 0.25 | 0.26 | 0.26|
| 2nd half year | 19-29 | 0.27 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.39 | 0.41 | 0.43 | 0.44 | 0.45 | 0.46 | 0.47|
| 30-39 | 0.25 | 0.24 | 0.23 | 0.22 | 0.21 | 0.21 | 0.20 | 0.37 | 0.39 | 0.41 | 0.42 | 0.43 | 0.44 | 0.45|
| 40-49 | 0.29 | 0.28 | 0.27 | 0.26 | 0.26 | 0.26 | 0.25 | 0.37 | 0.38 | 0.40 | 0.40 | 0.41 | 0.42 | 0.43|
| 50-59 | 0.26 | 0.26 | 0.25 | 0.24 | 0.24 | 0.24 | 0.23 | 0.34 | 0.35 | 0.36 | 0.37 | 0.38 | 0.39 | 0.39|
| Over 60 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.29 | 0.26 | 0.26 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25|
Table 4 shows the results of evaluating the cVS by expanding the combination of A and B in Table 3. In Table 4, when $A > B$ (dissatisfaction with misses is higher than dissatisfaction with false alarm), the cVS of the second half is higher than that of the first half. On the other hand, when $B > A$, cVS was variously evaluated based on the age of the user and the A and B combination.

Table 4 provides an explanation as to why relatively younger individuals are using the forecast more effectively (Table 3); with a lower perceived accuracy. To address this, a correlation analysis was performed between the cVS, shown in Table 4, and the perceived accuracy by age in the first and second half of 2017 in Figure 2. In Table 4, the shaded areas indicate cVS with a correlation coefficient of 0.7 or higher as a result of the correlation analysis. Hence, if the dissatisfaction due to a false alarm is 2, the dissatisfaction with a miss is estimated to be over 6. Because the dissatisfaction with misses is very large, the cVS in both the first and the second half is lower than 0.3, which may be a composite reason for lower satisfaction as well as perceived accuracy of users. The satisfaction and reliability regarding meteorological services were also low, at 71.3 and 70.8 points, respectively, for the general public.

Meanwhile, the optimal probability threshold (30-40%) that can be expected with high accuracy and cVS, and the forecasting users’ decision criteria (53.3% in the first half and 52.6% in the second half) are different from each other. The cVS can be estimated by creating a virtual forecast user group to analyze the effect of changing the current decision criteria into the optimal probability threshold. The new group can be obtained by rotating the graph of Figure 1 on the y-axis, with a probability threshold of 55%, as shown in Figure 4. However, if the y-axis is rotated based on the 55% probability threshold for the distribution in Figure 1, the average critical probabilities for the first and the second half of the year are 56.3% and 57.0%, respectively. This means that the members of the newly created group use a higher probability threshold than the existing one; hence, it is not appropriate as a comparison group in which a lower threshold probability should be used. The reason why the average of the probability thresholds of a new group is high is because many people selected a probability of 10% in Table 1. Therefore, people who chose a critical probability of 10% and 100% are left unchanged, and the remaining members are rotated. The average probability threshold of the new comparison group was 51.4% and 51.5% in the first half and the second half, respectively, and it is lower by 1.9%p and 1.1%p, for the same criterion, compared to the existing user group.

Table 5 shows the difference between the cVS of the comparison group and the existing group. The negative value in Table 5 indicates that the decision criterion of the existing group is superior to the comparison group.

In the 19–39 age group, the transition to the comparative group exhibits higher performance than the current group when A was 6 or more and B was 2. In other
words, it can be expected to increase the satisfaction value by lowering the average probability threshold used by the members of the group. 9 When A is large, it changes the probability threshold of users, and when B is large, raising the forecast accuracy is effective in raising the satisfaction value (forecast effect). The result of changing the satisfaction value of the 19–39 age group can prove the precedent study. However, it is difficult to expect an improvement in the satisfaction value only by changing the critical probability of the members aged over 60, and it appears that the age group 40–59 requires a different strategy selection according to the situation. This implies that detailed measures considering age and period of analysis are needed to achieve an increase in the satisfaction value of forecasts, rather than uniform efforts to change the probability distributions presented in previous research.

Finally, in order to maximize the satisfaction value of the group through the change in the probability threshold that users are using, reduction in the number of people who selected the 10% probability threshold in Figure 1 is required. Extreme probability thresholds, such as 10%, cause several false alarm situations, which drops the value of the forecast.

Conclusion

Based on the results of the questionnaire survey conducted by the Korea Meteorological Administration, the satisfaction value with rainfall forecasts was evaluated. Further, the degree of dissatisfaction with forecasting errors was estimated by linking the perceived accuracy of short-term forecast recognized by the forecast users to the satisfaction value.

From the analysis, it can be inferred that in order to improve the satisfaction value, the probability threshold distribution should be considered as important as the degree of dissatisfaction with the forecast error and the number of forecast-occurrence cases. Ultimately, when developing a service to improve the perceived accuracy and satisfaction of people who use weather forecast information, efforts to quantify how dissatisfied the forecast users are in a particular forecast error situation should be made.

It is estimated that the relative dissatisfaction level of the forecast user group in the missed situation of 2017 is at least 6 or more (when the Satisfaction level with Hit is 1). If the members of the group are very dissatisfied with the miss, then the meteorological community should try to provide a forecast with a probability higher than the users’ decision criteria (probability threshold), along with a publicity that encourages low-probability thresholds to be reflected in decision-making. Of course, the precedent is to investigate the exact dissatisfaction level and critical probability of individual forecast users.

It can be expected that the satisfaction value of members aged 19–39 can be increased only by attempting to convert the existing probability threshold distribution to the comparison group that rotates on the y-axis. On the other hand, it is shown that the probability-threshold change effort is not effective for members in their 60s or above, and it can be adversely affected by the unified policy implementation without consideration of the characteristics of the age group. A tailored strategy for each age group is required, and education for extreme critical probability users is needed. To utilize the users effectively, publicity about the meaning of the information provided with probability and the ratio of occurrence of the weather phenomenon according to the probability of provision among the public should be promoted. As shown in Figure 5, an extreme probability threshold, such as 10%, causes several false alarms, which in turn reduces the value of the forecast.

![Figure 4: Ratio of hits, misses, and false alarms according to the probability threshold of precipitation forecast with a 24-hour lead time in Seoul in 2017](image-url)

In this study, there is a limitation that detailed analysis cannot be performed due to the lack of raw data on the probability threshold criterion of individual users. In the future, more accurate analysis will be possible if the individual data of each respondent are accumulated. Nevertheless, it is significant that this study attempts to estimate the dissatisfaction with the forecast error of the
user group and suggests factors that should be considered when implementing the policy to improve satisfaction in the meteorological community. It is expected that it can considerably help to develop a policy that improves the satisfaction of future users.

**Ethical Clearance** - Not required

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**Conflict of Interest** - Nil

**References**


A Study on Life Sports Instructor’s Informal Learning Type and Learning Improvement Method

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Abstract

The purpose of this study was to present a life sports instructor’s learning type and learning improvement method through informal learning. To achieve the purpose of this research, this study selected 4 instructors of the life sports instruction field as research participants. In addition, this study brought to light on a life sports instructor’s learning type and the learning improvement method in depth using the ethnographic research method based on Spradley’s domain analysis and taxonomic analysis through the research participants’ case. The research results were as follows: First, This study could classify a life sports instructor’s learning type through informal learning into 5 sorts, i.e. ‘experience, learning, research, distribution, expansion.’ Second, As regards the learning improvement method for a life sports instruction through informal learning, learning environment should be constructed 1) from the personal and content-related aspects, 2) cultural and environmental aspects, and 3) institutional and organizational aspects. An instructor at a life sports instruction field is relatively lacking in the opportunity to get formal learning in comparison with office job workers. Conclusively, this study thinks that the informal learning type and learning improvement method have important educational significance for the increase in professionalism as a life sports instructor.

Keyword: Life sports instructor, informal learning, learning type, learning improvement, learning improvement method

Introduction

The instruction at a life sports field, unlike that at school physical education, or elite sports, is done mostly for general members of society (adolescents and adults etc.) as an instruction object. Moreover, the instruction of life sports is not limited to the technical guidance of each event only, but various roles covering program planning, operation, management, and assessment, etc. are required. Accordingly, an instructor of life sports is required to be equipped with the quality and ability as a sports expert available for such role performance. Therefore, the growth process into a sports instructor, who teaches and guides sports trainees, has an important influence on a sports instructor’s improvement in professionalism and ability.

The growth process into an expert in sports education can be largely divided into the three sorts, i.e. formal growth, formless growth, and informal growth. Formal growth literally means that it is made through formal sports expert education. In short, there is a certain form of institutionalization and rules in formal sports expert education and it can be called an intentionally organized education mostly by the systematic curriculum. Accordingly, this education refers to the one investing a person with a transcript, academic degree, and certificate.

Formless growth, as an education achieved in a short period, refers to the education of the form like a workshop, or seminar and conference. In a case of sports instruction experts who carry out routinely tight business, it is never easy to participate in formal education. However, formless education is done spontaneously in a comparatively short period, and this education can be called a comparative organized learning opportunity while it is conducted outside of a formal education institution. Accordingly, formless education could be
conducted continuously and extensively according to a sports instructor’s participatory will. In a sense, this education is an extension of formal education by classification of the growth process.

In contrast, informal education can be called an educational behavior, or learning method considerably differentiated from the aforementioned formal & formless growth. In one word, informal growth is the form that makes it possible for a learner to get an education from daily experiences. This form includes actual instruction experience or learning through natural experience in daily routines, and experiential or executive learning conducted on the basis of a learner’s self-directedness & autonomy at a workplace. Accordingly, self-directed learning is a much similarly used term to informal learning.

The effect of informal learning in corporate environments has been reported continuously since the 1990s. According a research by the United States Bureau of Labor Statistics, seventy percent of new knowledge in the workplace is obtained through informal learning. Dobbs also explained that seventy percent of learning that contributes to the overall working knowledge is generated in informal manners. Moreover, the study reported that ninety percent of materials learned in the workplace are the result of informal learning, rather than formal learning.

The informal learning like this is the lesser-known area notwithstanding that it is the most frequently conducted form, and also the most influential learning domain among the conducted learning at an everyday field, and the general perception of its importance and interest in this form are pretty insufficient. In addition, most of the research is judged that a company’s actual investment in learning is lopsided on formal learning. However, interest in and research on informal learning for life sports instructors, who work in a complex and diverse area, is insufficient compared to the importance of the subject. Therefore, this study aimed to look into a life sports instructor’s informal learning type through the qualitative research on instructors involved in a life sports field, and soon after the process, to present a learning improvement method through informal learning.

Research Method

Participant in research: The subject of the current study is life sports instructors, who are sampled via quota selection strategy, a criterion-referenced selection method. This method is primarily used in quantitative studies because an important criterion for sampling research subjects is whether they have sufficient information adequate for research objectives.

In specific, participants in the current study currently work for sports centers and institutions related to life sports, and are life sports instructors with diverse experiences ranging from five to twenty years. Four life sports instructors were selected, all of whom are actively engaging in self-development learning and informal learning activities and have an interest in the topic and objectives of the current study. Table 1 shows the characteristics of the study participants.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>Instruction Career</th>
<th>Main Major Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kim</td>
<td>Male</td>
<td>47</td>
<td>20years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Swimming</td>
</tr>
<tr>
<td>Lee</td>
<td>Male</td>
<td>45</td>
<td>17years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Swimming, Fitness, PT</td>
</tr>
<tr>
<td>Park</td>
<td>Female</td>
<td>36</td>
<td>10years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aerobics, PT, GX</td>
</tr>
<tr>
<td>Choi</td>
<td>Male</td>
<td>31</td>
<td>6years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fitness, PT, GX</td>
</tr>
</tbody>
</table>

**Data collection:** The current study collected data through in-depth interview, non-participatory observation, and related documents. In-depth interview, which was the primary data collection method, were categorized into official and unofficial interviews, with the former utilizing semi-structured method, and the latter conducted in non-structured method.

Official interviews were individually executed, with a running time of forty to sixty minutes, and a participant was given three to four sessions. Unofficial interviews were conducted as required, for ten to twenty minutes per each session. The researcher in the current study visited the workplace of the interviewees, in places that the participants preferred to give them a comfortable environment.

Overall in-depth interviews were recorded under the agreement of research participants, in order to prevent the researcher from missing any interview data.
In addition, non-participatory observation and related documents were collected in the current study in order to supplement interview data and better understand informal learning conditions. The non-participatory observation data was collected by watching the study participants’ actual class instruction and other work activities to understand their working environment, as well as to supplement information lacking in the in-depth interview data. Collected documents involved various information regarding informal learning and life sports instructors.

Data analysis: In-depth interview data was primarily used in the analysis of the current study, with non-participatory observation and document data playing auxiliary roles. First, two sessions of coding the in-depth interview data were conducted, after which the processed data was analyzed according to the objectives of the study. The current study made an effort to maintain the emic (perspective as internal players) of the study participants in the process of analysis and used domain analysis and taxonomic analysis techniques, introduced in Spradley’s as ethnographic research methods.

In specific, among the data coded twice, there were seventy-seven data points that served the objectives of the current study. Through domain analysis, these coded data points were then categorized into eight areas, which were in turn classified into two key topics after taxonomic analysis. The two key topics are learning type and learning improvement method of life sports instructors achieved through informal learning.

Verity of research: As reliability and validity in quantitative studies are explained in terms of truthfulness and certainty, the current study implemented triangulation, member checks, and peer debriefing processes that increase validity and reliability of the overall domain and taxonomic analyses. In addition, the research made sure to prevent the collected data from interfering with the participants’ private lives, in consideration of the ethical guidelines for a study of this kind.

Results and Discussion

Five learning types and three learning improvement methods were identified as informal learning experienced by the life sports instructors in their field. The results of the classification are displayed below.

Life sports instructor’s learning type through informal learning

This study could classify a life sports instructor’s learning type through informal learning into 5 sorts, i.e. ‘experience, learning, research, distribution, expansion.’ In addition, different types of informal learning were organically interrelated to each other, forming a benevolent cycle closely tied to the process of beginner life sports instructors obtaining experience and becoming experts in their field.

Experience: In general, learning takes place as acquired knowledge and techniques are applied to the context of actual working environment and using them to solve problems. In particular, using newly-obtained knowledge in the field is crucial: Since the same knowledge can be applied differently depending on a diverse range of situational contexts, the learner must enter into problematic situation, work to solve it by applying his or her knowledge to the field. Simply put, the learner understands what was not understood during text-based or oral learning in the process of getting hands-on experiences.

“In general, I get explanations with words, which I can understand to a certain degree. But when I am faced with the actual situation, I get confused, and I have to experience the actual to make the knowledge my own (Kim).”

“Although I receive sufficient instruction and understand it, the field of life sports are rife with diverse situations. So, I think no two situations are the same. It must be because my students all have different features. As such, it is difficult to respond with simple verbal explanation. Nothing happens according to my expectations. It is more so when there is no experience to back up the knowledge (Lee).”

As there are numerous variables in the actual workplace, the worker will learn by a ceaseless cycle of trial and error as he or she applies the acquired knowledge. While experiences of failure can engender negative emotions at the time, but it becomes deeply ingrained in the mind, which prevents the worker from making the same mistake.

“Beginner instructors make many mistakes and experience much difficulty when working in the field for the first time. They are usually very disconcerted
about the experience, but they become more careful and calmer as time passes. They learn on their own while going through this process (Kim).”

Even after receiving an explanation and experiencing the field, one cannot immediately understand uncommon and unfamiliar tasks just by couple instruction sessions. The life sports instructor must write down the knowledge in a journal or a note and learn the knowledge repeatedly. In addition, as attempts to make the acquired knowledge one’s own accumulate, at a certain point all of the experiences bind into one, leading the life sports instructor to experience true learning in which the knowledge is fully made into his or hers. At the end, life sports instructors experiencing certain problems and situations directly are a learning type that influences informal learning.

Learning: With an almost bare background in the field, beginner instructors begin learning by understanding the atmosphere in the workplace, studying the vocabulary, and accepting various stimulations. They stay in the field of life sports instruction to watch experienced instructor talk to each other and the students and conduct other types of tasks. Through this process, the beginner instructor is familiarized into the workplace atmosphere and vocabulary, and obtains an overall understanding of knowledge required for the workplace.

“I was puzzled at first, because I did not know what the [experienced instructors] were talking about and doing. But still, I sat and listened to their conversations and instructions (Choi).”

“I thought spending time together [with the experienced instructors] was most important. Learning the work functions and other information formally was also important, but what helped me a lot was spending time with [experienced instructors] and being with them in the field (Park).”

Life sports instructors, with a will to learn about the workplace, seek ways to approach the diverse learning materials. They require basic data such as learning materials, expert instruction manual, or other guidelines that can be utilized in an actual work process. Rather than taking interest in theoretical knowledge needed to understand their work, the beginner instructors look for information that can be immediately applied to the workplace and directly help the. In addition, when they are not satisfied with the internal information, they actively seek out external information.

“I looked far and beyond, because I did not know. I looked for any information out there, and where I could find it. It is good to have materials like a manual, since I will be able to read it when I have questions (Lee).”

Acquisition of information and knowledge through internet falls under this category. With well-organized document or text-based information, however, getting hands-on experience at the site is often more effective for learning. In order to learn more practical tasks, as such, life sports instructors visit the field to experience the workplace.

That is, because workplaces for life sports instructors do not feature separate training session for new employees, most of the instructor learning is executed in their daily work routine. This can be problematic, as more experienced instructors rarely take time to approach the beginning instructors and provide explanations about the work process. As such, new instructors’ first approach more experienced colleagues to find answers to their questions. Talking to instructors at a similar level can also help, because employees with similar levels of experience can more pertinent information through an understanding of each other’s knowledge. Such situation in the life sports instruction workplace can be expressed as learning, a type of informal learning.

Research: A process of introspection is important in internalizing the knowledge acquired by practice. Many learners neglect to focus or contemplate on the events of the past, wasting the value of precious knowledge from field experience. As such, it is important for life sports instructors to think about the lessons learned from their experiences, and organize ideas about the kinds of efforts required to build upon such lessons.

“I look back about what I did well and what I did not. That makes me realize what I should do in the future (Lee).”

“After finishing a task or solving a problem, I take time to contemplate on the process after work hours. It is a sort of self-reflection. I do this from time to time (Park).”

After beginning life sports instructors become familiar with their work, they begin seeking deeper knowledge directly and indirectly related to their
tasks. For example, they research theoretical aspects of their practice, or make efforts to obtain certifications regarding their work.

“Life sports instructors in the field are not very interested in the theory when they start out. But after they gain more experience and become familiar with their work, they begin taking interest in such aspects. How do I put it... It is a process of deepening (Choi).”

Viewing their field of work based on the gradually accumulating know-how allows the instructors to see elements that require improvement or rationalization, or those that are irrational. This makes them work to make improvements to resolve complaints from colleagues or customers, or enhance factors that they felt were inconvenient. In this, the instructors first make work-related knowledge and skills as their own, and move on to acquire deeper knowledge to change their work environments. This process can be rationalized a research, another informal learning type of life sports instructors.

**Distribution:** By recording and passing on the know-hows they accumulated, life sports instructors look for ways to help their newer colleagues. This process can generate opportunities for instructors to naturally systemize practical know-hows or unsystematic knowledge, and allow them to organize their acquired knowledge in their minds.

“There is only so much that a person can remember, so I make a sort of ‘know-how notebook,’ where I write down what I learned from the field, as well as knowledge, experience, methods, and cautions. I have a book of my own on work knowledge (Lee).”

Experienced life sports instructors wish to pass on their know-how to their junior colleagues, in order to provide advice and guide as a senior professional with longer experience and more know-hows, and to train their successors who will continue their work. In providing instruction to less experienced employees, senior instructors can find what they did not know before, and come across new perspectives that offer new chances for learning.

“When new instructors come, I think about what and how much to tell them. I study or prepare for these opportunities, since I have to provide some direction to new instructors who do not know anything about the field (Kim).”

“[New instructors] sometimes ask me things that I never thought about. This can be difficult, but it is an opportunity to learn more about my job (Park).”

In this process of distribution, accumulated know-how is organized and distributed, which shows that this learning type also offers opportunities for life sports instructors to engage in informal learning.

**Expansion:** If instructors were more interested in their own area of work in their workplace, in this new phase they expand their horizon to the outside. They work to find implications from other sports centers or life sports facilities to apply what they learned to their workplace.

“I try to go to academic seminars and workshops related to life sports to exchange information and discuss points for improvement as often as possible. Staying in one place for a long time prevents me from following the trend and fall behind (Park).”

Expansion of perspective regarding their professional area also takes place. After their focus on their own professional field, life sports instructors actively accept changes to the professional environment and make efforts to complement where they are behind.

“The times and environment are rapidly changing. I think I should follow the trend without falling behind. I am a bit old, but in order to be a leader and not die out, I think I need to take interest in areas that are not in my expertise. The future world will emphasize creativity and convergence (Lee).”

Solid understanding of their own professional area allows life sports instructors to expand that perspective outside. This shows that even highly experienced life sports instructors sustain learning activity, which can be expressed as expansion, an informal learning type.

**Learning improvement method for a life sports instruction through informal learning**

As regards the learning improvement method for a life sports instruction through informal learning, learning environment should be constructed 1) from the personal and content-related aspects, 2) cultural and environmental aspects, and 3) institutional and organizational aspects.
Personal and content-related aspects: First, instructors need to actively accept trial and error. They repeat the process of failure and learning from their mistakes while applying their acquired knowledge to internalize it. Trial and error in this case negatively impacts performance in short term, but a long-term aspect of learning, it is a necessary learning process crucial to owning the knowledge.

Second, encouragement for developing expertise is required. In order for the instructors to enhance expertise, they must harbor the will to become a key member of their professional community and voluntarily engage in learning activities. The organization, in turn, must boost life sports instructors’ sense of belonging and develop their expertise.

Third, the necessity of change and its direction must be suggested; the organization must bring up the need for change and propose its direction, that is, a vision. Experienced life sports instructors have expert knowledge and know-hows about their professional area, as well as a high drive and love for their organization and work. As such, leaders of life sports instruction institutions should propose directions by harmonizing the visions and values of experienced instructors intend to achieve by learning new areas with the visions and values of the organization.

Cultural and environmental aspects: First, there must be an interest and consideration for learning activities of the beginning instructors, who require advice and help from more experienced colleagues due to their near lack of knowledge on their work. However, in a culture in which work is at the center while learning is considered auxiliary, new employees have to mind the mood of more experienced colleagues who are busy, even if they have questions. In addition, when the day is busy learning takes a backseat to getting the work done. As such, life sports instruction organizations must understand the necessity of systematic learning for new instructors, and work to create a norm friendly to learning.

Second, instructors must be allowed to participate in decision-making. A culture must be created, in which instructors and the organization regularly share information and instructors actively take part in decision-making process. In the process of developing a new program, for example, instructor opinions should be respected as those coming from experts, which will enhance their motivation to nurture their expertise through learning. It is desirable to allow instructors to directly and indirectly participate in decision-making not only for field work, but also for policy changes that impact their working conditions. In the end, improving organizational policies under the agreement of life sports instructors can improve the ownership of these professionals.

Third, defensive norm working against changes must be removed. Current life sports instructors should take a change-oriented attitude in which they accept new motivations from inside and outside of the organization to enhance the areas of knowledge that they are familiar with. Many organizations, however, are afraid of risks that come with change, thereby methodically rejecting new elements. This can arrest organizational and personal development, which in turn maintaining negative aspects of the workplace. In the end, actively accepting change and jumping into new areas create opportunities for learning, which in turn engenders sustained innovation.

Institutional and organizational aspects: First, information infrastructure must be established, in order to build a place for sharing knowledge. This will allow the instructors to share resources for learning and accumulate knowledge, in addition to informing them of organizational management information and giving them an outlet to express their opinions.

Second, rewards for merit must be provided, which is required to stimulate the efforts for learning that can enhance the expertise of the instructors. This not only refers to rewards for simple work performance, but also to those for personal capabilities. Such merit-based system promotes instructors based on their ability to perform their job regardless of their education or rank, in addition to providing compensation for their performance within their rank. Under this system, the instructors are more likely to make efforts to improve their expertise in a systematic manner because promotions and compensations are made in accordance with abilities.

Third, instructors should be allowed to freely make proposals. Over-regulatory policies can make the instructors feel that their autonomy is violated. As such, if there are activities that can contribute to the instructors’ personal learning and development of the organization, life sports instruction institutions should
induce employees to want to engage in such activities, rather than requiring them to employ them. Such changes can continue to improve the working environments for life sports instructors in the field.

**Conclusion**

An instructor at a life sports instruction field is relatively lacking in the opportunity to get formal learning in comparison with office job workers. Moreover, it’s difficult for the instruction field environment to find an opportunity to get systematic learning for the increase in professionalism as a sports expert. However, a life sports instructor is required to be equipped with upskilling and specificity which do close interaction with learning participants having various demands and characteristics. Conclusively, this study thinks that the informal learning type and learning improvement method have important educational significance for the increase in professionalism as a life sports instructor.

**Ethical Clearance** - Not required

**Source of Funding** - Self

**Conflict of Interest** – Nil

**References**


7. Sorohan, E.G., We do; Therefore, we learn. Training & Development, 47 (10): 47-54, 1993.


Effect of Pre-hospital Advanced Life Support Simulation Training on Paramedic’s Competency

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Abstract

Background/Objectives: The study was performed to assure the effect of a simulation training of Advanced Life Support (ALS) in paramedics in pre-hospital situation.

Methods/Statistical analysis: This was a nonequivalence control quasi-experimental study. The subjects were 16 paramedics in K fire department, 8 paramedics in experimental group and 8 paramedics in control group. The study method consisted of conventional education and simulation education practice training. Pre-hospital ALS was gauged by 5-point Likert scale. Higher score signifies better performance skills. The data were analyzed using software SPSS/WIN 22.0. The significance level set was p<0.05.

Findings: The outcome of this study showed that simulation training is more effective than conventional education. The total electrocardiogram score and sub-item (rhythm, medical evaluation) scores were higher in the experimental group. There were statistically significant differences between simulation training group and conventional education group. The total Advance airway score was 14.62±0.74 in the experimental group, 12.12±0.64 in the control group. There was statistically significantly higher score in the experimental group. The total fluid treatment score and sub-item (IV fluid, drug, medical evaluation) scores were higher in the experimental group. There were statistically significant differences between simulation training group and conventional education group. The total Leadership teamwork score was 22.50±2.61 in the experimental group, 18.75±1.66 in the control group. There was statistically significantly higher score in the experimental group. The total ongoing assessment score was 19.15±1.03 in the experimental group and 14.50±0.75 in the control group. There was statistically significantly higher score in the experimental group.

Improvements/Applications: In conclusion, applying simulation education program is important not only for the new paramedic, but also for emergency medical technology student and health and medical service personnel.

Keywords: Pre-hospital, Advanced life support, Simulation training, Paramedic, Performance.

Introduction

In the evaluation of paramedics, limited specialist first aid (CPR, intubation, and intravenous) item has been continued as an exercise focused on showing rather than medical viewpoint. There is a shortage of paramedics ‘ability to reply to changes of the patients’ condition during first aid treatment and to assess the severity of patients and the ability of paramedics to evaluate their abilities. It is urgent to develop specialized simulation scenarios and evaluation methods for quick application of the paramedic. The results of the study that Simulation-based training was applied to two groups of nursing students showed the performance skills of the simulated practice group were better than the performance of theoretical training group [¹].
In Korea, the effect of simulation training on emergency personnel is very limited. Furthermore, due to the special case of cardiac arrest in CPR related education, simulation education through virtual scenarios is an important education that can improve clinical performance ability rather than theoretical education [2]. Various types of simulation training are also offered in the medical profession. Research is ongoing from students to emergency clinicians [1, 3]. And the ability of paramedics to cope with changes in patient status during first aid and evaluate the degree of severity of patients hardly assessed. It is urgent to develop specialized simulation scenarios and evaluation methods to prepare enlargement the scope of work of EMT-paramedics. There is a report that educating students by using highly efficient mannequins can improve their performance [4]. Thus, it was necessary to develop a Korea-style evaluation items using the high-performance mannequins and simulation equipment for objective evaluation, and the first-aid evaluation methods related to the smart medical guidance pilot project. We will contribute to improving the 119 paramedic capacity by changing the paramedics’ evaluation methods to meet the special emergency treatment level. The objective of this study was comparative analysis of the job performance before and after the simulation training for first class emergency rescue personnel belonging to the firefighting school. Also, the study could provide basic data for effective emergency resuscitation in case of emergency cardiac arrest and to provide guidance on the educational effect of emergency rescue specialist resuscitation. Namely the study was performed to identify the effects of pre-hospital simulated advanced life support (ALS) training on the skills of paramedics and verify that simulation training is an efficient education method for improving clinical practice ability [5, 6, 7].

The sub-scale includes items such as electrocardiogram (rhythm, medical evaluation), advanced airway (intubation, medical evaluation), fluid treatments (IV fluid, drug, medical evaluation), leadership and teamwork (team management), Medical direction, Ongoing assessment (vital sign, paperweight, physical examination).

The development process of the pre-hospital simulation ALS intervention program is as follows. Firstly the researchers participated in ALS training of K firefighting school simulation center and K university simulation training. Secondly the researchers drafted program. Thirdly the first written program was reviewed, revised and supplemented by two paramedics, two emergency medical professors, and two KALS lecturers as shown in Table 1.

The training contents of the simulated ALS were as follows. The training time of this program was based on the existing ALS and the results of the study [8, 9, 10]. After theoretical training for 30 minutes, practical training will go along. Firstly the instructors demonstrated the basic life support (BLS) for 3 minutes and then practice for 10 minutes per person. And ALS training was performed by instructor for 5 minutes, and then 10 minutes of practice per person and debriefing for 2 minutes. Total practice time was 30 minutes per person and 120 minutes per team. Training program is based on the contents of 2015 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care presented by the American Heart Association, a standardized guide to professional cardiac resuscitation. The theoretical training contents include BLS, defibrillation, emergency medicine,
ALS algorithm and electrocardiogram such as asystole, Ventricular fibrillation, Pulseless ventricular tachycardia (PVT), pulseless electrical activity (PEA), Bradycardia, Tachycardia. Practice training consists of mixed scenario that BLS and 6 style electrocardiograms such as asystole, PVT, VF, PEA, Bradycardia, Tachycardia [5, 6, 7]. For The theoretical training, audiovisual materials and handout are prepared. For the practice training, simulated arrest scenarios and the mannequin: Advanced Life Support and Emergency Care Simulator (ALS HAL S1000 Simulator, USA) were prepared. The instructor has a BLS qualification and was trained by Emergency Medical Doctors and Emergency Department Professors who were trained in the program contents before the program was implemented. In addition, the training method utilized a debriefing method that enables the research subjects to instantly evaluate the performance skills in digital form according to their own scenarios after individual practice so as to promote the technique of performing cardiac resuscitation. Based on the precedent study, the theoretical education is composed of group lectures, and the practical training is 4 persons suitable for the role of each individual team leader, and one group, each group, and each individual demonstration, practice, and debriefing was composed [11, 12].

Table 1. Pre hospital simulation based ALS training program

<table>
<thead>
<tr>
<th>Contents</th>
<th>Theoretical training (30min)</th>
<th>Practical training (per person 30min, per team 120min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education contents</td>
<td>•Lecture •Electrocardiograms (asystole, Ventricular fibrillation, Pulseless ventricular tachycardia, pulseless electrical activity, bradycardia, tachycardia.) •Defibrillation, •Emergency medicine in cardiac arrest, •BLS, ALS algorm</td>
<td>•BLS-mannequin •Demonstration of mixed scenario of BLS and 6 style electrocardiograms (asystole, PVT, VF, PEA, bradycardia, tachycardia) •Practice by team(4persons (2- BLS, 2- ALS) •Personal practice •Debriefing</td>
</tr>
</tbody>
</table>

Statistics

The pre-hospital specialist CPR score is “Excellent 5”, “Good 4”, “Average 3”, “Not enough 2”, “Very poor 1”. Pre-hospital ALS was gauged by 5-point Likert scale. Higher score signifies better performance skills. The data were analyzed using software SPSS/WIN 22.0. The significance level set was p<0.05.

Results and Discussion

For the subject’s homogeneity, general characteristics and ALS performance of two groups were checked. There were no statistically significant differences between two groups as shown in table 2 and table 3. Those meant two groups’ homogeneity
Table 3. Homogeneity of ALS performance

<table>
<thead>
<tr>
<th>Skills</th>
<th>Experimental (n=8)</th>
<th>Control(n=8)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD</td>
<td>Mean±SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrocardiogram (rhythm, medical evaluation),</td>
<td>total</td>
<td>total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.50±2.56</td>
<td>8.25±2.91</td>
<td>0.223</td>
</tr>
<tr>
<td></td>
<td>Medical assessment</td>
<td>1.75±0.88</td>
<td>2.13±1.12</td>
</tr>
<tr>
<td>Advance airway</td>
<td>total</td>
<td>total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.00±3.92</td>
<td>5.25±0.88</td>
<td>0.239</td>
</tr>
<tr>
<td></td>
<td>Medical assessment</td>
<td>2.00±1.30</td>
<td>2.00±1.30</td>
</tr>
<tr>
<td>Fluid treatment (IV fluid, drug, medical evaluation),</td>
<td>total</td>
<td>total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.50±5.39</td>
<td>16.87±5.54</td>
<td>0.893</td>
</tr>
<tr>
<td></td>
<td>Medical assessment</td>
<td>1.88±0.64</td>
<td>2.00±0.92</td>
</tr>
<tr>
<td>Leadership teamwork</td>
<td>total</td>
<td>total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.87±3.13</td>
<td>8.62±1.99</td>
<td>0.577</td>
</tr>
<tr>
<td>Medical director</td>
<td>total</td>
<td>total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.00±1.30</td>
<td>4.87±0.99</td>
<td>0.833</td>
</tr>
<tr>
<td></td>
<td>Medical assessment</td>
<td>1.00±0.00</td>
<td>1.00±0.00</td>
</tr>
<tr>
<td>Ongoing assessment</td>
<td>total</td>
<td>total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11.37±2.38</td>
<td>11.50±3.02</td>
<td>0.928</td>
</tr>
</tbody>
</table>

The total electrocardiogram was 13.50±1.06 in the experimental group, 11.00±1.30 in the control group. The total electrocardiogram score and sub-items (rhythm, medical evaluation) scores were higher in the experimental group. There were statistically significant differences between simulation training group and conventional education group. The total Advance airway was 14.62±0.74 in the experimental group, 12.12±0.64 in the control group. The score of experimental group was significantly higher than score of control group. The total fluid treatment was 32.87±1.45 in the experimental group, 26.12±1.12 in the control group. The total fluid treatment score and sub-items (IV fluid, drug, medical evaluation) scores were higher in the experimental group. There were significant differences between simulation training group and conventional education group. The total Leadership teamwork was 22.50±2.61 in the experimental group, 18.75±1.66 in the control group. The score of experimental group was significantly higher than score of control group. The total Medical direction was 16.87±2.47 in the experimental group, 14.00±1.30 in the control group. The score of experimental group and score of control group were significantly different in Medical direction. The total ongoing assessment was 19.15±1.03 in the experimental group and 14.50±0.75 in the control group. The score of experimental group was significantly higher than score of control group as shown in table 4.

Table 4. Differences in the techniques of performing resuscitation after education

<table>
<thead>
<tr>
<th>Skills</th>
<th>Experimental (n=8)</th>
<th>Control(n=8)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD</td>
<td>Mean±SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrocardiogram (rhythm, medical evaluation),</td>
<td>total</td>
<td>total</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>13.50±1.06</td>
<td>11.00±1.30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical assessment</td>
<td>4.38±0.74</td>
<td>3.75±0.46</td>
</tr>
</tbody>
</table>
This study presented that effect of simulation training was much better than the conventional education in ALS. The simulation training is very effectual in improving the clinical performance of paramedics compared to the conventional education. The simulation training may give experiences of the virtual cardiac arrest situation to the paramedics. Simulation education is an educational method that can cope with the limitations of activities that cannot be performed in the practice field because of protection in the right to health and safety and right consciousness of patients. So, Simulation education is an educational method that improves the coping ability for emergency situations. Therefore, a simulation-based emergency education program including specialized cardiac resuscitation must be developed and applied so that new paramedics can cope with the accident and cope with the accident without confusion in the field emergency situation. The results of the previous study on nurses working in the ICU and emergency room revealed that simulation training group had high scores of ALS knowledge and higher performance skill score than the traditional education group. In this study, the experimental group that provided simulation-based ALS training had better scores than control group in performance skill score of the ALS after treatments. The results of this study presented that experimental group showed higher scores in the performance technique compared to the comparative group, because simulation based practice helped the adaptation to the unfamiliar situation and environment by exercising the teamwork in accordance with the situation in the experimental procedure. 

It is coherent with the result of a study that the clinical performance scores of experimental group were significantly enhanced after simulation-based training was given to the new nurses in the ICU. In this study, after conducting the team-based learning and situation-based training for the experimental group and the team-based simulation ALS training after the technical training, the post-evaluation was carried out. There was a limit to improve the clinical performance ability only by the traditional lecture and partial practical skill training. Also, there are many differences in the teamwork part. In the sub-domain results of this study, in the pre-evaluation of the patients in the field confirmation items and in the medical evaluation in the electrocardiogram, the score of the performance technique in experimental group was higher than the score of performance in control group, but they were significantly different. Since the simulation training programs have proved to be more effective in promoting the clinical performance of the new paramedics than the traditional lecture and practical training, it is thought that this simulation training program can be applied to the first aid education method of the new emergency paramedics.

Conclusion

The aim of this study was to confirm the effect of simulation training on the job performance of paramedics performing pre-hospital ALS. The results were as follows. The performances of the simulation

<table>
<thead>
<tr>
<th></th>
<th>total</th>
<th>14.62±0.74</th>
<th>12.12±0.64</th>
<th>0.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advance airway</td>
<td>Medical assessment</td>
<td>5.00±0.00</td>
<td>4.25±0.46</td>
<td>0.000</td>
</tr>
<tr>
<td>Fluid treatment (IV fluid, drug, medical evaluation),</td>
<td>total</td>
<td>32.87±1.45</td>
<td>26.12±1.12</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>fluid</td>
<td>18.50±1.51</td>
<td>14.50±0.92</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>drug</td>
<td>14.37±0.96</td>
<td>11.62±0.91</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Medical assessment</td>
<td>4.25±0.46</td>
<td>3.50±0.53</td>
<td>0.000</td>
</tr>
<tr>
<td>Leadership teamwork</td>
<td>total</td>
<td>22.50±2.61</td>
<td>18.75±1.66</td>
<td>0.004</td>
</tr>
<tr>
<td>Medical direction</td>
<td>total</td>
<td>16.87±2.47</td>
<td>14.00±1.30</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>Medical assessment</td>
<td>4.13±0.64</td>
<td>3.00±0.00</td>
<td>0.000</td>
</tr>
<tr>
<td>Ongoing assessment</td>
<td>total</td>
<td>19.15±1.03</td>
<td>14.50±0.75</td>
<td>0.000</td>
</tr>
</tbody>
</table>
training group were higher than those of the conventional education group in the electrocardiogram performance skill, the special intubation performance skill and fluid treatment performance. In the leadership and teamwork performance, the medical guidance performance, and the evaluation performance during transfer, the performance of simulation-based training group was higher than that of traditional education group. In conclusion, this study confirms that the simulation training program is more effective in enhancing the clinical performance of the new paramedics than the traditional lecture and practical training. Therefore, applying simulation education program is important not only for the new paramedic, but also for emergency medical technology student and health and medical service personnel.

Ethical Clearance - Not required

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Conflict of Interest –Nil

References


A Comparative between Virus Type 1 Original Sabin Polio Virus and Sabin AFP Case in Cytopathic Effect Characteristic

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Abstract

Acute flaccid paralysis (AFP) is a clinical syndrome characterized by rapid onset of weakness, affecting the muscles then progressing to maximum severity within several days to weeks and sometimes may lead to death. National Polio Laboratory (NPL/IRAQ) is the reference laboratory that is responsible for the laboratory part of AFP surveillance project and a total of two hundred and fifty (250) stool samples were collected during the period (March to November 2017) from all Iraqi provinces. The main aimed of this study was isolating and differentiate of poliovirus strains type 1 AFP (Sabin virus) from the stool samples of children received polio vaccine and suffering with acute flaccid paralysis. Then comparative with original strains of sabin polio vaccine type 1 in cytopathic effect characteristic. CPE is the visible result of viral infection. Current study shows For each type of polio infections have specific phenotypical CPEs on cell culture. When compare viruses’ CPEs characteristic between sabin polio virus strain 1 and original Sabin polio virus strain 1 there are more differ occurred after inoculation on cell culture. CPE rate with sabin polio virus AFP strain 1 consider at high multiplicity of infection MOI and all CPEs occur rapidly with increase in cell morbidity rates because it have severe type of CPE called Total destruction CPE. While the study show that CPE of original Sabin strain type 1 are weakly.

Keywords: cytopathic effect characteristic; sabin AFP case; virus type 1; original sabin polio virus; and National Polio Laboratory.

Introduction

Enteroviruses (genus Enteroviruses, family Picornaviridae) are among the most common viruses infecting humans all over the world. Enteroviruses are associated with diverse clinical syndromes ranging from minor febrile illness to severe, potentially fatal conditions e.g., aseptic meningitis, encephalitis, paralysis, acute flaccid paralysis, especially in children, myocarditis, and neonatal enteroviral sepsis and could be linked with the development of some chronic diseases e.g., type 1 diabetes and dilated cardiomyopathy. Each year, an estimated 10-15 millions of symptomatic Enterovirus infections occur in the United States.

The genus enteroviral group includes Coxsackievirus, (enteric cytopathic human orphan viruses) Echovirus, and poliovirus. Enteroviruses are believed to have 3 distinct classes: polioviruses (types 1, 2, and 3) and nonpolioviruses (coxsackieviruses, enteroviruses, echoviruses, and unclassified enteroviruses). The poliovirus enters the human host through the gastrointestinal tract (GI) or respiratory tract. The infection can progress to CNS involvement during the major viremic phase or at a later time. Antibody production in response to polio infections occurs within the first 7-10 days.

The risk of infection is low socioeconomic status poor sanitation and living in overcrowded residential areas. Poliomyelitis is an acute communicable viral disease affecting humans that are considering the only natural hosts for polioviruses mainly young children.
The disease is caused by 3 serotypes of Poliovirus (Poliovirus types 1, 2, and 3), (6). The virus has been reclassified as Enterovirus spp. in the entero virus genus. The virus is transmitted through contaminated food and water and multiplies in the intestine, the incubation period is usually 7 - 14 days range 3 - 35 days, (21). It can invade the nervous system.

Many infected individuals may be asymptomatic but do excrete the virus in their faces, hence transmitting infection to others. Poliovirus was first identified in 1909 by injection of specimens into monkeys. The virus was first cultivated in the cell cultures in 1949. In 1948, (8) a new group of agents by inoculation into newborn mice from two children with paralytic disease. In about 1% of affected individuals, the virus enters the central nervous system and replicates in anterior horn cells, that is, motor neurons of the spinal cord. The typical neurological manifestation of paralytic poliomyelitis is acute flaccid paralysis (AFP) of limbs, predominantly lower limbs, usually asymmetric and with undamaged sensation (12). In rare cases; viral destruction of bulbar cells results in respiratory paralysis and even stopped.

Oral poliovirus vaccines (OPV) are the prevalent vaccine used in eradicating polio (23). There are different types of vaccine which may contain one, a combination of two, or all three different serotypes of attenuated polio virus which able to replicate effectively in the intestine, in some cases the live attenuated vaccine-virus in OPV can cause paralysis it is believed that this may be triggered by an immunodeficiency. The risk of vaccine-associated paralytic poliomyelitis (VAPP) occurs in most public health programmes as the result this vaccine (11).

More risk when the vaccine-virus may be able to circulate, mutate and, over the course of 18 months, reacquire neurovirulence and revert to wild virus this is known as a circulating vaccine-derived poliovirus (4).

Materials and Method

Cell lines

Healthy monolayer of L20B cell lines in maintenance medium (MEM supplemented with 2% fetal calf serum (FBS) were used in this study. The cells were seeded 48 hours earlier at a concentration of 105 cells per tubes in maintenance medium MEM supplemented with 2% FCS(13). Sterile procedure was adhered to throughout the laboratory study.

Processing of samples and virus isolation

Feecal samples were pre-treated with chloroform before being inoculated on a healthy monolayer of L20B cell lines in maintenance medium (MEM supplemented with 2% fetal bovin serum (FBS). The cells were seeded 48 hours earlier into culture tubes with growth medium (Eagle’s MEM supplemented with 10% FCS). Each stool sample was inoculated into both L20B cell (2). The inoculated monolayers were observed daily for the characteristic enterovirus cytopathic effects of rounded, refractile cells detaching from the surface of the tube. The tubes with CPE up to 75% and above were harvested and kept at −20°C to be passaged in fresh monolayer of the second cell lines to increase the titer, while those infected cells negative after 5 days of incubation were re-passaged on the same cell line (15), those found negative after another 5-day incubation period were declared negative. The tubes positive for poliovirus-specific cytopathic effects were freeze-thawed thrice, spun at 4°C (specify the rpm and time) and the supernatant aliquoted and kept frozen at −20°C as poliovirus isolates 22–24.

Intratypic differentiation of the Poliovirus (using serological method)

ELISA method for intratypic differentiation

Intratypic differentiation of the isolates, a test aimed at establishing whether poliovirus strain is type 1 or other type of polio (19), was carried out using an ELISA method as described by WHO manual and Adu et al (43).

Results

The detection of Sabine polio AFP-type 1

The prevalence for poliovirus type 1 (PV1 AFP case) was calculated by using children with positive samples as numerator and the total numbers of positive cases of polio record in this study as denominator. Table 1 shows total numbers isolates of polio AFP-type 1 isolates were 7 cases distribution in relation to location of the children who suffering with AFP in Iraq.

The result indicates that more poliovirus PV1 isolates were obtained from Baghdad province a total isolate AFP PV1 were 7/35 (20%) of these 3/7 (42.85%) cases record in Baghdad followed by Salahdeen having 2 cases (28.57%), (Table 1). While one case 1 (14.28%) obtained from Qadysia and Basra for each.
Table 1 :- frequencies of Sabine polio AFP-type 1

<table>
<thead>
<tr>
<th>provinces</th>
<th>Sabin (polio1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive cases</td>
<td>Percentage %</td>
</tr>
<tr>
<td>sabine polio viruses AFP 1</td>
<td></td>
</tr>
<tr>
<td>BG</td>
<td>3</td>
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<tr>
<td>BS</td>
<td>1</td>
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<tr>
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<tr>
<td>Total</td>
<td>7</td>
</tr>
</tbody>
</table>

Comparison between polio AFP type 1 and original type of (OPV 1)

This study is comparison between these two types of virus strains, which seemed to researchers that they are similar, but my study showed scientific facts of the differences between them, where the type of CPE were studied on each of the L cells separately and recorded many differences considerable in CPE appearance.

This comparison was conducted between the serotype of polio virus Original Sabin PV1 and AFP Sabin PV1, the CPEs of each virus was studied on the L20 B cells. A CPEs is the formation of the monolayer L20B cells damage due to viral infection this destruction of the cells in monolayer allows for easy analysis of viral growth (14).

During this study it was observed that CPEs of AFP Sabin PV1 was characterized by a total destruction of the monolayer cell is the most severe type of CPE observed on a confluent monolayer of a host cell is formed (figure 1). When the viral infection is introduced all cells in the monolayer shrink rapidly and become dense in a process known as pyknosis and detach from the glass surface within 1-2 days occur rapidly at low multiplicity of infection (MOI).

While CPEs caused by Original Sabin PV1 on monolayer L20B cell characterized by Sub-total destruction of L20B monolayer cell and less severe than destruction occur slowly within 5-6 days at low multiplicity of infection (MOI) this type of CPEs shows detachment of some but not all the cells in the monolayer (figure 2).

| Table 2 :- compare CPEs between Original Sabin (OPV-1) and Sabin AFP -1 |
|----------------|--------------------------------|
| CPE Feature | Original Sabin (OPV-1) | Sabin AFP -PV1 |
| CPE appear time | after 5 to 6 days | after 1 to 2 days |
| Rate with low MOI | occur slowly | occur rapidly |
| level of severity on cells | less severe | severe type |
| CPE Type | sub-Total destruction | Total destruction |
| Cells detachment from surface | Few cells | All cells |
| site of effect | Localize | pyknosis |
| Cell shape | Enlarged, rounded, refractile | Same |
Discussion

All poliovirus strains are appear similar serotype but there is a different phenomenon in our study when Comparison between sabin polio AFP strains and original strains of (OPV) according to CPEs characteristic and final titer TCID<sub>50</sub> study shows Many of the differences were recorded among them .

A major concern about OPV is its ability to revert to a form that can cause paralysis. Outbreaks of vaccine-associated paralytic poliomyelitis (VAPP) have been reported in many countries of the world, (17, 20). In 2005, it was reported that children in a small village in the United States had contracted vaccine-derived polio. And In Nigeria more than 70 cases have been reported. Also In 2006 about 1600 cases of vaccine-induced polio occurred in India according to the Indian Medical Association Sub-Committee on Immunisation’s report on the Polio Eradication Initiative. (9) The incidence of Acute Flaccid Paralysis (AFP) in India is now 12 times higher than expected and coincides with huge increases in OPV doses being given to children in the quest to ‘eradicate’ wild type polio infection and paralysis. while India has been polio-free for a year, there has been a huge increase in acute flaccid paralysis (AFP). In 2011, there were an extra 47,500 new cases of AFP. Clinically indistinguishable from polio paralysis but two was dead, the incidence of AFP was directly proportional to doses of oral polio received. (10) Study In China find all polioviruses isolated from patients with AFP were Sabin poliovirus AFP study confirm that Increasing frequency of Sabine polio viruses AFP type 1 record 7 cases, (7) this result agree with our results that was also found the predominant serotype in Iraq were AFP type 1 record 7 cases ( 20% )

Conclusions

This study confirms presence of Sabin polioviruses type 1 were isolated from AFP cases among vaccinated children in Iraq. Transmission of Sabin poliovirus AFP type 1 among children with complete vaccinated by oral polio vaccine poses a serious threat to polio eradication program in iraq. viruses’ CPEs characteristic of Sabin polio virus AFP strain 1 are occurred rapidly with increase in cell morbidity rates and high multiplicity of infection MOI compared with original Sabin polio virus type 1 OPV 1. this study use Cytopathic Effects to detection different types of polio virus which has a high sensitivity and eligible to alimit of 1 infectious dose that contains 50 to 1,000 copy s virions of polio infection.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

References


Antibacterial Activity of *Lactobacillus* spp. Against *Listeria monocytogenes*

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Abstract

A total of 18 *Lactobacillus* isolates were obtained from 37 clinical samples. All the isolates were subjected to morphological, microscopic examination, biochemical tests and molecular identification by 16S rRNA, the results showed that isolates belongs to *Lb. fermentum*, *Lb. rhamnosus* and *Lb. paracasei*. Also, in this study 46 samples from different sources were collected in order to isolate *Listeria monocytogenes* but unfortunately no isolate was acquired, however, eight isolates of this bacteria were obtained from Joint Diseases Unit, College of Veterinary Medicine, University of Baghdad and the identification of these isolates was confirmed by morphological, microscopic examination and API Listeria test. *Lactobacillus* isolates were screened for their antibacterial activity against *L. monocytogenes* by agar-wells diffusion method and agar-plug method. The results showed that the agar-plug method is better than agar-wells diffusion method and *Lb. fermentum* isolated from mouth recorded high inhibition activity against *L. monocytogenes*, while *Lb. paracasei* recorded low inhibition activity against it. It is concluded that the inhibitory effect of *Lactobacillus* isolates of the same species varies within the same and different source of isolation.

Keywords: *Lactobacillus*, *Listeria monocytogenes*, Antibacterial activity

Introduction

Listeriosis is a disease caused by *Listeria monocytogenes* and it is considered one of the general medical issue inferable from its high case fatality rate¹. Foodborne listeriosis cases were accounted for after utilization of polluted food products, for example, vegetable, undercooked meat, dairy products, and fish products. Because of the increased resistance of bacteria to antibiotics, the need for alternatives to antibiotics has increased. *Lactobacillus* is the largest genus included in lactic acid bacteria (LAB), it is commonly found in raw milk, dairy products, fermented milk²-³, meat⁴, pickled vegetables⁵, sourdoughs⁶, fermented tea leaves⁷, fermented sausage⁸, fermented beverage⁹, oral cavity during the first years of a child’s life¹⁰, and also in the genital and intestinal tracts of man and animals¹¹. Many antimicrobial substances are produced by *Lactobacillus* such as short-chain fatty acids¹², bacteriocins¹³, hydrogen peroxide¹⁴ and lactic acid¹⁵. *Lactobacillus* is considered as probiotic due to its many benefits such as treatment of diarrhoea, bacterial vaginosis, acute gastroenteritis in children and prevention of endotoxin production¹⁶. Due to the seriousness of listeriosis disease, this study was aimed to investigate the antibacterial activity of *Lactobacillus* against *L. monocytogenes*.

Materials and Method

Culture media

MRS broth, MRS agar (Oxoid, Germany), CHROMagar™ Listeria (CHROMagar, France), Brain heart infusion (BHI) agar (Hi-Media, India), Tryptone Soy Broth Yeast Extract (TSBYE) was prepared according to Simpson and co-workers¹⁷ and SL agar was prepared according to Washington¹⁸.

Collection of Samples and Isolation of *Lactobacillus*

A total of 37 clinical samples were collected from Health Center Kadhimiya I and clinics in Baghdad, Iraq. Samples were immersed in MRS broth and transferred...
to laboratory in ice box and then they were streaked on MRS agar supplemented with 1% CaCO$_3$ and plates were incubated anaerobically at 35°C for 48 hours. After incubation, white creamy colonies were selected and transferred to SL agar and then the colonies were purified by streaking on MRS agar and incubated under the same incubation conditions above.

**Identification of Lactobacillus**

*Lactobacillus* species were identified depending on morphological, microscopic examination$^{19}$, biochemical tests$^{20,21,22,23}$ and molecular identification by 16S rRNA.

**Collection of Samples and Isolation of Listeria monocytogenes**

A total of 46 samples were collected from clinical and food sources, as well as, eight isolates were obtained from Joint Diseases Unit/ Faculty of Veterinary Medicine/ University of Baghdad, they were cultured on CHROMagar™ Listeria and re-subjected to identification tests. Samples were immersed in TSBYE medium tubes and transferred to laboratory in ice box and incubated aerobically at 35°C for 48 hours. After that, each sample was streaked on CHROMagar™ Listeria and incubated under the same incubation conditions above$^{24}$.

**Identification of Listeria monocytogenes**

It was identified depending on morphological, microscopic examination$^{25}$ and API Listeria (BioMérieux, France).

**Antagonistic effect of Lactobacillus against Listeria monocytogenes:**

**A-Agar-wells diffusion method**

Activated *Lactobacillus* isolate was inoculated into MRS broth and incubated anaerobically at 35°C for 24-48 hours and then supernatant was obtained by centrifuging at 6000rpm for 15 min. The 0.1ml of activated *L. monocytogenes* isolates were transferred and streaked on BHI agar. Wells were made using cork borer (6mm) and filled with supernatants of *Lactobacillus* isolates and then the plates left in laboratory temperature for one hour, after that, they were incubated aerobically at 35°C for 18-24 hours. After incubation, the inhibition zones were measured and recorded$^{26,27,28}$.

**B-Agar-plug method**

A 0.1ml of activated *Lactobacillus* isolate was transferred and streaked on MRS agar and incubated anaerobically at 35°C for 24-48 hours. The 0.1ml of activated *L. monocytogenes* isolates were transferred and streaked on BHI agar. Cork borer (6mm) was used to cut pieces of MRS agar which *Lactobacillus* grown on it , transferred to BHI agar and incubated aerobically at 35°C for 18-24 hours. After incubation, the inhibition zones were measured and recorded$^{28,29}$.

**Statistical Analysis**

Least significant difference –LSD test was used to significant compare between means in this study$^{30}$.

**Results and Discussion**

Depending on the morphological, microscopic and biochemical examinations as well as, the molecular identification, eighteen isolates were identified as *Lactobacillus* spp.; seven isolates as *Lb. fermentum*, six isolates as *Lb. rhamnosus* and five isolates as *Lb. paracasei* (table 1). *Lactobacillus* isolates when grown on MRS agar showed white color, convex, creamy and smooth, circular colonies with entire margin and surrounded by white halo as a result of dissolving CaCO$_3$ in the acid produced by the bacteria$^{31}$, while showed white color, large, convex, little mucoid, smooth and circular with entire margin on SL agar$^{32}$. Gram stain showed purple rods that occurred singly, in pairs or in short chains and non-spore forming$^{33,34}$ (Figure 1). All the bacterial isolates were catalase, oxidase and gelatinase negative; they were not able to produce ammonia from arginine except *Lb. fermentum*$^{35}$.

**Figure 1:** *Lactobacillus fermentum* isolated from mouth
Table 1: Numbers of Lactobacillus isolates from clinical samples

<table>
<thead>
<tr>
<th>Source of isolation</th>
<th>No. of samples</th>
<th>No. of Lb. fermentum</th>
<th>No. of Lb. rhamnosus</th>
<th>No. of Lb. paracasei</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouth</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vagina</td>
<td>15</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stool</td>
<td>8</td>
<td>0</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Milk</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37</strong></td>
<td><strong>7</strong></td>
<td><strong>6</strong></td>
<td><strong>5</strong></td>
</tr>
</tbody>
</table>

According to morphological, microscopic and biochemical examinations, no isolate were identified as L. monocytogenes from the forty-six samples, this may be due to the increased cultural and health awareness. However, eight isolates that obtained from Joint Diseases Unit, Faculty of Veterinary Medicine, University of Baghdad when grown on CHROMagar™ Listeria medium showed blue color, small, convex, diameter less than 3mm, circular colonies with entire margin and surrounded by white halo due to a specific phospholipase activity. Gram stain showed purple rods that occurred singly or in pairs and non-spore forming. So, according to morphological, microscopic and API Listeria test, these eight isolates were identified as L. monocytogenes.

Antibacterial activity of Lactobacillus against L. monocytogenes was done by agar-wells diffusion method and agar-plug method. The results in tables 2 and 3 show agar-plug method made higher inhibition zones than agar-wells diffusion method. The results also show L. monocytogenes L3 isolate was highly sensitive to Lactobacillus isolates especially the isolates (Lb1, Lb2, Lb3, Lb4, Lb6, Lb7, Lb8, and Lb9) where the diameters of inhibition zones were (15.5, 22.5, 15.5, 14.5, 15.5, 14, 14, and 15) mm, respectively. There was significant differences (P <0.05) between diameters of inhibition zones of Lb2 and the other isolates while there was no significant differences between diameters of inhibition zones of isolates Lb1, Lb3, Lb6, Lb9, Lb4, Lb7, and Lb8. The ability of Lactobacillus isolates to inhibit the growth of pathogens is clearly strain- and culture condition dependent and that several molecules, antimicrobial substances such as organic acids, hydrogen peroxide, carbon dioxide, and bacteriocins as well as mechanisms are involved in the inhibition process in vitro as reported by Siro.

Table 2: Antibacterial activity of Lactobacillus isolates against Listeria monocytogenes isolates using agar-wells diffusion method

<table>
<thead>
<tr>
<th>Lactobacillus isolate</th>
<th>Listeria monocytogenes isolates (Diameter of inhibition zone, mm)</th>
<th>LSD value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>Lb1</td>
<td>-</td>
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</tr>
<tr>
<td>Lb2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lb3</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Lb4</td>
<td>13.5</td>
<td>12</td>
</tr>
<tr>
<td>Lb5</td>
<td>13</td>
<td>12.5</td>
</tr>
<tr>
<td>Lb6</td>
<td>13</td>
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<td>Lb7</td>
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<td>Lb9</td>
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</tr>
<tr>
<td>Lb10</td>
<td>12</td>
<td>13.5</td>
</tr>
<tr>
<td>Lb11</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>
Cont... Table 2: Antibacterial activity of *Lactobacillus* isolates against *Listeria monocytogenes* isolates using agar-wells diffusion method

<table>
<thead>
<tr>
<th>Lactobacillus isolate</th>
<th>L.1</th>
<th>L.2</th>
<th>L.3</th>
<th>L.4</th>
<th>L.5</th>
<th>L.6</th>
<th>L.7</th>
<th>L.8</th>
<th>LSD value</th>
</tr>
</thead>
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<tr>
<td>Lb1</td>
<td>10</td>
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<td>12</td>
<td>3.75*</td>
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<td>Lb2</td>
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<td>14</td>
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<tr>
<td>Lb3</td>
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<td>14</td>
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<td>10</td>
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<td>3.91*</td>
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<td>15.5</td>
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<td>10</td>
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<td>3.62*</td>
</tr>
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</tr>
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<td>3.98*</td>
<td>4.72*</td>
<td>4.17*</td>
<td>---</td>
</tr>
</tbody>
</table>

(-) No inhibition zone, *(P<0.05).

Table 3: Antibacterial activity of *Lactobacillus* isolates against *Listeria monocytogenes* isolates using agar-plug method

<table>
<thead>
<tr>
<th>Lactobacillus isolate</th>
<th>Listeria monocytogenes isolates (Diameter of inhibition zone, mm)</th>
<th>LSD value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>L.1</td>
<td>L.2</td>
</tr>
<tr>
<td>Lb1</td>
<td>10</td>
<td>-</td>
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<td>Lb2</td>
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<td>Lb3</td>
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<td>Lb18</td>
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</tr>
<tr>
<td><strong>LSD value</strong></td>
<td>3.05*</td>
<td>5.61*</td>
</tr>
</tbody>
</table>

(-) No inhibition zone, *(P<0.05).*
Conclusion

The inhibitory effect of the Lactobacillus isolates of the same species varies within the same and different source of isolation. It is noted that the agar-plug method makes higher inhibition zones compared to agar-wells diffusion method and Lb. fermentum isolated from mouth has high rate of inhibition activity against L. monocytogenes L3 isolate, followed by Lb. rhamnosus while Lb. paracasei has low rate of inhibition.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

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17. Simpson, CA., Geornaras, I., Yoon, Y., Scanga, JA., Kendall, PA., Sofos JN. Effect of inoculum


Anti-inflammatory and inflammatory as Diagnostic Markers in Type2 Diabetes Mellitus

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²MSc. Department of Pharmaceutical Chemistry in University of Kerbala, Iraq

Abstract

The diabetes mellitus is more globally chronic metabolic disorder that characterized by chronic hyperglycemia result from insulin deficiency and /or resistance to the action of insulin. this study is design to evaluate the serum level of TNFα and adiponectin in type2 diabetic patients and also to discriminate the diabetic patient from the control .present study included 80 individuals divided to 40 type 2 diabetic patient and 40 healthy control subjects the blood samples were collected from all participants to made the laboratory analysis. Results show that The gender, age and BMI was matched between patients and control subjects. The serum level of adiponectin was significantly lower in diabetic patients (p<0.05). The serum level of TNFα was significantly higher in diabetic patients in compared to controls (p<0.05).The lipid profile was significantly higher in diabetic patients in compared to controls .The ROC curve analysis show that the adiponectin and TNF have high sensitivity and specificity for diagnosis the diabetic patients, the optimal cut point was ≤15.3 and >40 for adiponectin and TNF respectively.

Conclusion: The serum level of adiponectin decreased significantly in type2 diabetic patients and also the serum level of TNF was increased significantly in T2DM patients .the adiponectin and TNF can used to distinguished the T2DM patients . The deficiency of adiponectin regareded as a risk for developing T2DM.

Keywords : adiponectin, TNFα, T2DM, increased significantly.

Introduction

Diabetes mellitus (DM) is chronic metabolic disorder; characterized by hyperglycemia due to absolute or relative insulin deficiency[1].The pathogenic processes that involves in the development of diabetes are ranged from autoimmune destruction of β-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action[2]. The risk of developing this form of diabetes increases with age, obesity, and lack of physical activity. It occurs more frequently in women with previous gestational diabetes mellitus and in individuals with hypertension or dyslipidemia. Impaired insulin action (insulin resistance) is a reduced sensitivity in body tissues to the action of insulin and it occurs when target tissues are unable to respond to normal circulating concentration of insulin[3]. In response, β-cells in the pancreas need to secrete increased amount of insulin to maintain euglycemia. However; over time, functional defects in insulin secretion prevent the β-cells from maintaining high rates of insulin secretion. Insulin resistance is strongly associated with obesity and physical inactivity, and several mechanisms mediating this interaction have been identified. A number of circulating hormones, cytokines, and metabolic fuels, such as free fatty acids (FFA) that originates in the adipocytes and modulate insulin action[4]. Several groups provided strong evidence to support the concept of adipose tissue as an endocrine organ producing cytokines which modulate glucose hemostasis. Tumor Necrosis Factor alpha (TNF-α) is a cytokine produced by adipocytes that may contribute to the development of insulin resistance in obesity. TNF-α can impair insulin action on glucose metabolism and

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increase lipolysis\(^5\).

At the molecular level, TNF-\(\alpha\) increases serine phosphorylation of IRS-1 and down regulate GLUT-4 expression, thereby contributing to insulin resistance. White adipose tissue (WAT) has been increasingly recognized as an important endocrine organ that secretes a number of biologically active\(^6,7\) “adipokines” such as adiponectin. The inflammatory response contribute to the development of variety of diseases such as atherosclerosis and diabetes mellitus\(^8\). Also the adiponectin plasma levels are reduced in individuals with obesity, T2DM and cornary artery diseases all these conditions have a low grade of inflammation\(^9\). ADPN is known to act as an antioxidant, anti-inflammatory, antiapoptotic and antifibrotic protein then its low levels may predispose it to a loss of any or all of the above known protective features\(^10\).

**Method**

This study was conducted on 40 patients with type2 diabetes mellitus who have been selected from patients attending the diabetic center in Imam AL-Hussein Medical city, those patients diagnosis as diabetic according to the American Diabetic Association Criteria [FBG].And 40 apparently healthy persons as controls. fasting serum glucose ,HbA1c,triglycerides,total cholesterol, HDL cholesterol and LDL cholesterol also measured for all participant in this study

Serum was collected from all participants included in the study and store at -70c until TNF alpha, adiponectin and insulin measurement were performed. TNF\(\alpha\) level were measured using Elabscience human TNF\(\alpha\) ELISA kit. The insulin level was measured by using demeditic insulin Elisa kit based on sandwich principle .Adiponectin serum levels were measured using clone cloud corp ELISA kit.

The statistical analysis were calculated by using SPSS ( versin 20) programmed ,the descriptive data expressed as mean standard deviation and the data that was no normally distributed used median and interquartile range . Two samples \(t\) test used to analyze the differences in means between two groups (if both follow normal distribution). Mann Whitney U test is used to analyze the differences in median of two groups (if they do not follow normal distribution). Receiver operator curve is used to see the validity of different parameters in separating cases

**Results**

There was no significant difference in the age and sex and BMI between study group as shown in table (1).The glycemic index was significantly higher\(<0.001\) in diabetic patients in comparison with controls. The total cholesterol, LDL-c and triglyceride were significantly higher \(<0.001\) in diabetic patients, also the HDL-c was significantly lower in diabetic patients compared to controls. The serum insulin level was significantly higher \(<0.001\) in diabetes in addition to the serum level TNF\(\alpha\) also was higher \(<0.001\) in diabetes in contrast the adiponectin level was lower significantly\(<0.001\) in diabetic patients.

<table>
<thead>
<tr>
<th>Table 1 demographic data of subject in the study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control</strong></td>
</tr>
<tr>
<td>Number</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>BMI (kg/m(^2))</td>
</tr>
<tr>
<td>Sex, number (%)</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
</tbody>
</table>

Data presented as mean ± SD

**Table 2 biochemical laboratory parameters for study subjects.**

<table>
<thead>
<tr>
<th></th>
<th><strong>Control subjects</strong></th>
<th><strong>Diabetic patients</strong></th>
<th><strong>P value</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>40</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>HbA1c (mmol/L)</td>
<td>5.3 ± 0.5</td>
<td>9.0 ± 1.9</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>FBS (mmol/L)</td>
<td>99.2 ± 9.2</td>
<td>229.4 ± 90.6</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Triglyceride (mmol/L)</td>
<td>107.9 ± 45.1</td>
<td>222.7 ± 133.4</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>Cholesterol (mmol/L)</td>
<td>176.4 ± 33.0</td>
<td>188.2 ± 44.5</td>
<td>0.002</td>
</tr>
<tr>
<td>LDL (mmol/L)</td>
<td>100.7 ± 21.1</td>
<td>125.3 ± 27.8</td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>HDL (mmol/L)</td>
<td>45.2 ± 10.8</td>
<td>40.9 ± 9.7</td>
<td>0.006</td>
</tr>
<tr>
<td>Insulin ((\mu)mol/L)</td>
<td>16.05 (13.93-18.97)</td>
<td>22.52 (16.22-30.14)</td>
<td>(&lt;0.001^b)</td>
</tr>
<tr>
<td>TNF (\alpha) pg/ml</td>
<td>16.0 (6.5-24.3)</td>
<td>70.66 (55.6-110.3)</td>
<td>(&lt;0.001^b)</td>
</tr>
<tr>
<td>Adiponectin ng/ml</td>
<td>16.66 (16.13-17.20)</td>
<td>14.58 (14.11-14.95)</td>
<td>(&lt;0.001^b)</td>
</tr>
</tbody>
</table>

Data presented as mean ± SD

b-Data presented as median (50%) and interquartile range (25% to 75%)
Table 3 ROC analysis of (Adiponectin, insulin and TNFα) to discriminate between controls and Diabetes.

<table>
<thead>
<tr>
<th>Marker</th>
<th>AUC</th>
<th>95%CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adiponectin</td>
<td>0.992</td>
<td>0.955 – 1.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TNF-alpha</td>
<td>0.943</td>
<td>0.886 – 0.977</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Insulin</td>
<td>0.781</td>
<td>0.696 – 0.851</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 4 validity of investigated markers and its optimal cut point to discriminate between control and diabetes.

<table>
<thead>
<tr>
<th>Marker</th>
<th>Cut point</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adiponectin</td>
<td>≤15.17</td>
<td>96.3%</td>
<td>97.5%</td>
<td>98.7%</td>
<td>95.9%</td>
</tr>
<tr>
<td>TNF-alpha</td>
<td>&gt;40.33</td>
<td>90%</td>
<td>92.5%</td>
<td>96%</td>
<td>82.2%</td>
</tr>
<tr>
<td>Insulin</td>
<td>&gt;19.33</td>
<td>67.5%</td>
<td>82.5%</td>
<td>88.5%</td>
<td>55.9%</td>
</tr>
</tbody>
</table>

Figure 1: ROC curve of investigation diabetes and control persons.
Table 6: Comparison of the OR between diabetes and Control subjects

<table>
<thead>
<tr>
<th>Variables</th>
<th>OR</th>
<th>95%CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adiponectin</td>
<td>0.007</td>
<td>0 - 0.106</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>TNF-alpha</td>
<td>1.081</td>
<td>1.047 – 1.117</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Insulin</td>
<td>1.207</td>
<td>1.091 – 1.336</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>FBS</td>
<td>1.193</td>
<td>1.061 – 1.341</td>
<td>0.003</td>
</tr>
<tr>
<td>HbA1c</td>
<td>24.738</td>
<td>3.451 – 177.339</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Discussion

Diabetes mellitus is most potent non communicable disease that affect many peoples around the world, and its lead to many complication that increase the morbidity and mortality of the patients\(^3\). There are many risk factor for developing the diabetes the prominent factors are the physical inactivity, obesity and insulin resistance\(^\text{11}\). Diabetes mellitus is not a single entity but rather a heterogeneous group of disorders in which there is a distinct genetic pattern as well as environmental factors and pathophysiologic mechanisms that lead to impairment of glucose tolerance\(^\text{12}\). Insulin resistance is strongly associated with obesity and physical inactivity, and several mechanisms mediating this interaction have been identified\(^\text{13}\). A number of circulating hormones, cytokines, and metabolic fuels, such as free fatty acids (FFA) that originates in the adipocytes and modulate insulin action. An increased mass of stored triglyceride, leads to large adipocytes that are themselves resistant to the ability of insulin to suppress lipolysis this results in increased release and circulating level of FFA and glycerol, both of which aggravate insulin resistance in skeletal muscle and liver\(^\text{14,15}\). These FFA can influence insulin signaling pathway by activating several serine/threonine kinases, reducing the tyrosine phosphorylation on IRS and impairing IRS/phospho-inositide-3-kinase pathway\(^\text{16,17}\). Tumor Necrosis Factor alpha (TNF-α) is a cytokine produced by adipocytes that may contribute to the development of insulin resistance in obesity\(^\text{18,19}\). TNF-α can impair insulin action on glucose metabolism and increase lipolysis. At the molecular level, TNF-α increases serine phosphorylation of IRS-1 and down regulate GLUT-4 expression, thereby contributing to insulin resistance\(^\text{20,21}\).

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

Reference


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Isolation and Identification of *Streptococcus pyogenes* from Patients with Tonsillitis in Baghdad Province

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Wessam Abbas Hashem Icheeid\(^1\)

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Abstract

The present study included isolation of 40 samples of *Streptococcus pyogenes* from throat clinical samples. The research results indicated that infections of *Streptococcus pyogenes* in children are greater than in adults. Therefore, clear that the age group patients (5 - 9) years recorded highest percentage of injury with throat infection (pharyngitis), so that the infection percentage reached to 22 (55.0%). Compared with other age groups which recorded the percentage 8 (20.0%) in the age group (<5) years. While the age group (10-15) years recorded the percentage 10 (25.0%) relatively to all cases. Also this study show the distribution of cases studied according to the gender. The results show that the percentage of male’s infection is higher than females’ infection. So that the number and percentage of males infection were 25 (62.5%), compared with females infection were 15 (37.5%), and in urban are greater than rural, which were 26 (65.0%). While the incidence percentage in rural patients were 14 (35.0%). showed that most of *S. pyogenes* isolates were resistant against erythromycin, while they sensitive for vacomycin and penicillin by using disc diffusion technique.

**Keywords:** *Streptococcus pyogenes*, throat clinical samples , Vacomycin, Penicillin, Tonsillitis

Introduction

*Streptococcus pyogenes* can be defined as a non-motile, gram-positive, and non-spore making spherical cocci with (0.5-1.0µm), that have the ability of making long chains in the liquid’s medium \(^1\). *Streptococcus* includes several species categorized via differential pathogenic potential. These bacteria could be well-thought-out as members of microbial physiological flora, yet, they also have the ability to cause severe or minor infections, and life-threatening cases. Beta-hemolysing species are the cause of most of streptococcal etiology’s infections \(^2\). Furthermore, several diseases result from Lancefield group a streptococcus, *Streptococcus pyogenes*, are among the most difficult to public health specialists and clinicians. Even though that serious infections resulting from *Streptococcus pyogenes* are quite unusual, influencing about 3 for each 100,000 of population annually in advanced nations, death is high compared to various other infections. Some possible control precautions are still indefinite, and a lot of characteristics related to their epidemiology still not grasped clearly, even though there are a lot of researches discussing their characteristics and occurrence \(^3\).

Consequently, *Streptococcus pyogenes* is considered as the main source of simple bacterial pharyngitis and tonsillitis usually denoted as strep throat. Patients having some sort of allergy to penicillin will be directed for taking Erythromycin \(^4-6\).

Severe pharyngitis and tonsillitis are considered the most regular clinical diseases caused by GAS bacteria. Cervical adenitis, retropharyngeal abscesses, sinusitis, otitis media are the purulent complications that may affect untreated patients. The impact of streptococcal respiratory tract infection associated mainly to its non-supportive squeal and severe morbidity, i.e., severe acute glomerulonephritis (GN) and rheumatic fever \(^7\). While the sensitivity and antibiotic susceptibility for these bacteria, had showed different levels of sensitivity and resistance \(^8\). So, this research was implemented to measure the commonness of group *a streptococcus*...
pyogenes infection among patients suffering from acute tonsillopharyngitis and its antibiotics.

**Materials and Method**

A total of 40 sample were collected from different clinical sample in Baghdad/Iraq during the period from (Nov. 2017 to March 2018) these samples were collected from patients suffering from infection by taking swabs from throat, who attending to different medical centers in Baghdad province. Bacteria were cultured on Mac Conkey, Nutrient, blood and mullerhinton agar in aerobic condition \(^{(9,10,24)}\) then they identified by conventional biochemical test.

**Results**

Figure (1), show the distribution of cases studied according to the gender. The results show that the percentage of males infection are higher than females infection. So that the number and percentage of males infection were 25 (62.5%), compared with females infection were 15 (37.5%) of all the total cases 40.

![Fig.1: Distribution the cases study according to the gender](image)

The figure (2), demonstrated the distribution of cases studied according to the age groups. Based on the results obtained from these results, it’s clear that the age group patients (5-9) years recorded highest percentage of injury with throat infection (pharyngitis), so that the infection percentage reached to 22 (55.0%). Compared with other age groups which recorded the percentage 8 (20.0%) in the age group (<5) years. While the age group (10-15) years recorded the percentage 10 (25.0%) relatively to all cases, which were 40.

![Fig.2: Distribution the cases study according to the age groups](image)

While the figure (3), appear the distribution of cases studied according to the residence. Therefore the results of this study were recorded the highest percentage of injury with throat infection among urban patients, which were 26 (65.0%). While the incidence percentage in rural patients were 14 (35.0%), of the total number of patients, which were 40.

![Fig.3: Distribution the cases study according to the residence](image)

**Fig.(4): Distribution the cases study according to the sensitive for some antibiotics**

So that the isolated and diagnosed bacteria in this study which were *Staphylococcus pyogenus*, shows sensitivity to some antibiotics such as Penicillin and Vancomycin, so that the ratio were 14 (35.0%). While this bacteria were shown sensitivity to other antibiotics such as Penicillin alone, therefore the ratio were 7 (17.5%). But the Vancomycin recorded 5 (12.5%). Also the antibiotics Chloramphenicol, Vancomycin, Penicillin and Ceftriaxone recorded percentage 4 (10.0%). While the Penicillin, Chloramphenicol, Penicillin, Vancomycin and Ceftriaxone, Penicillin, Vancomycin and Chloramphenicol recorded 2 (5.0%) in respectively.

![Fig.4: Distribution the cases study according to the sensitive for some antibiotics](image)

**Fig.(5): Distribution the cases study according to the resistance to some antibiotics**

But the figure (5), show the distribution of cases studied according to the resistance to some antibiotics. So that the isolated and diagnosed bacteria in this study which were *Staphylococcus pyogenus*, shows resistance to some antibiotics such as Erythromycin, which were 27 (67.5%), while the antibiotics Cefixime which were recorded 11 (27.5%). But the Oxytetracycline recorded the ratio 2 (5.0%), for all cases that examined, which were 40.
Fig.(5): Distribution the cases study according to the resistance to some antibiotics

Discussion

The result in the figure (1), show the distribution of cases studied according to the gender. The results show that the percentage of males infection are higher than females infection. So that the number and percentage of males infection were 25 (62.5%), compared with females infection were 15 (37.5%) of all the total cases 40. These results and the results of [12] are not similar, as they identified the commonness of GAS transmission in pre-school children in Makah city, Saudi Arabia. From Feb-May 2014 and in 7 various areas in Makah, the conducted research included 2370 Saudi and non-Saudi children of age between 4 and 6 from 19 kindergarten schools. Group A streptococcus have been isolated from (1.5%) of 2370 asymptomatic children. From the 36 isolates, 20 were females and 16 were males. These results correspond with the results of [13], as they showed that serious Streptococcus pyogenes infection have been elevating in ageing individuals (>75 years), the rate related to male patients (3.65 vs. 2.98), that demonstrate additional case – patients have been identified across all groups of age, usually young grownups of age (15-44), for whom the rates have been 61 percent higher in male than female patients (3.44% vs. 2.14%).

This result refers to the bacteria S. pyogenes infection in males more than females should not be neglected compared with females, or that males did not complete antibiotics to get rid of the infection. But the result of this study demonstrated the distribution of cases studied according to the age groups. the age group patients (5-9) years recorded highest percentage of injury with throat infection (pharyngitis), so that the infection percentage reached to 22 (55.0%). Compared with other age groups which recorded the percentage 8 (20.0%) in the age group (<5) years. While the age group (10-15) years recorded the percentage 10 (25.0%) relatively to all cases, which were 40. This result consistent with [12], as they suggested that the main colonization of Streptococcus pyogenes was 17(1.6 percent) in 5 years age group. Boys have high commonness (1.6 percent) compared to girls (1.5 percent). Though these results do not agree with [14], as they suggested that many epidemiological researchers have recognized high-rate of invasive Streptococcus pyogenes infection in males compared to females, pattern which could be noted for countless other invasive bacterial infections and one which is not grasped completely. Age-related rates of incidence express a usual distribution with J shape, ageing individuals have the highest rate, then come the infants. That can be caused by the fact that Streptococcus pyogenes infections could be identified in individuals of any age, even though the commonness of infection in children is higher, perhaps it is due to group of multiple exposures such as host immunity and nurseries or schools. Correspondingly, the commonness of pharyngeal infection is highest in children older than 3 years and was labeled as a ‘dangerous in school-aged children’ [15]. It is uncommon that neonates will experience this disease, that could indicate a protective, trans placentally-acquired immunity [14]. Although This results in the figure (3), appear the distribution of cases studied according to the residence. Therefore the results of this study were recorded the highest percentage of injury with throat infection among urban patients, which were 26 (65.0%). While the incidence percentage in rural patients were 14 (35.0%), of the total number of patients, which were 40. This result is consistent with [10], as they suggested that 200 children had growth of bacteria in culture. Streptococcus pyogenes was existing two percent of children in control group in Sao Paulo city and in eight percent of cultures in children from nursery school, Porto Velho city, without important difference between the two (p=0.18). Nevertheless, these results tend to disagree with [17], as they found that 9557 condition (3.8 for each 100 000 individual each year) with 1116 fatalities (case-fatality rate, 11.7%). The fatality rates for NF, STSS and septic shock 29, 38 and 45, respectively. The yearly rate was highest in individuals of 65 years old or more (9.4/100 000) or residents in
nursing homes, fresh surgery, NF, meningitis, isolated bacteremia, septic shock, emm type one or three, pneumonia, and underlying immunosuppression or chronic illness. Approximately 10 649–13 434 condition of invasive Group A *Streptococcus* infection happen yearly in US, causing 1136–1607 fatalities. Regarding 30-valent Mprotein vaccine, emm types responsible for 91 percent of isolates.

This is because going out of the warm home to the outside where the cold weather leads to inflammation, as well as eat everything cool. While the figure (4), show the distribution of cases studied according to the sensitive for some antibiotics. So that the isolated and diagnosed bacteria in this study which were *S. pyogynus*, shows sensitivity to some antibiotics such as Penicillin and Vancomycin, so that the ratio were 14 (35.0%). While this bacteria were shown sensitivity to other antibiotics such as Penicillin alone, therefore the ratio were 7 (17.5%). But the Vancomycin recorded 5(12.5%). Also the antibiotics Chloramphenicol, Vancomycin, Penicillin and Ceftriaxone recorded percentage 4(10.0%). While the Penicillin, Chloramphenicol, Penicillin, Vancomycin and Ceftriaxone, Penicillin, Vancomycin and Chloramphenicol recorded 2(5.0%) in respectively. These results agree with [18], as they proved that GAS is considered as one of the main causes associated to infections of respiratory tract. Assessing the sensitivity of *streptococcus pyogenes* isolates to some antibiotics and identifying these isolates acquired from infections related to respiratory tract are the two main aims of this research. Through utilizing standard disk diffusion approach, forty strains were isolated and their sensitivity to seventeen antibiotics were examined.

One hundred percent of the forty isolates showed resistance to tetracycline. Additionally, these isolates showed sensitivity to levofloxacin, vancomycine, teicoplanin and chloramphenicol, offering possible different treatment against *streptococcus pyogenes* infections. Due to the fact that penicillin is usually the choice for treating tonsillopharyngitis resulting from *streptococcus pyogenes*, meta-analysis showed that oral cephalosporins (like cepodoxime proxetil and cefadroxil) appeared to of higher efficiency than the oral penicillin, through two-times less clinical and bacteriological failures. Failure through using penicillin is uppermost in retreating conditions where cephalosporins are of higher efficiency. The cephalosporins’ higher activity is mostly associated to additional significant ability of *streptococcus pyogenes* eradication, could be because of their higher effectiveness in killing ingested bacterial cells [19]. But the figure (5), show the distribution of cases studied according to the resistance to some antibiotics.

So that the isolated and diagnosed bacteria in this study which were *S. pyogenus*, shows resistance to some antibiotics such as Erythromcine, which were 27(67.5%), while the antibiotics Cefixime which were recorded 11(27.5%). But the Oxytetra recorded the ratio 2 (5.0%), for all cases that examined, which were 40. These results agree with [20], as they stated that isolates of *streptococcus pyogenes* presented extreme sensitivity to levofloxacin, vancomycin and teicoplanin. Additionally, low values of MIC of were presented by these molecules. Even though the resistance of Tetracycline has been recognized with all the strains, this is due to the fact that cephalosporins and amoxicillin have been completely active against *streptococcus pyogenes*, as stated before. These results correspond with [21], as the data stated in Baltic, Eastern and Central European nations, Nepal and Turkey, showed no resistance to β-lactams among *streptococcus pyogenes* isolates which were identified. The existence of OH-radical on penicillin G is the main advantage of amoxicillin compared to penicillin G, that provides better bioavailability and develops constancy and gastrointestinal absorption.

**Conclusions**

The *S. pyogenes* isolates showed a resistant profile to cefixime and erythromcine and showed a good sensitivity toward penicilli/chloramphenicolz and vancomyci although some *S. pyogenes* were resistant to these antibiotics.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding

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Impact of Anesthesia on Adaptive Immune Response in Orthopedic Surgery

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Abstract

Background: Anesthesia is thought to be main factor affecting patients’ postoperative outcomes. Current study was carried out to evaluate the possible role of anesthetics and surgery on cellular immunity by measuring serum levels of IL-2 and IL-10 as well as CD4 and CD8 lymphocytes counts.

Materials and Method: Serum levels of IL-2 and IL-10 cytokines were measured by using enzyme linked immunosorbent assay (ELISA) technique. Flow cytometry was used to determine CD4 and CD8. Comparisons for statistical significance were performed using Mann-Whitney U test.

Result: Observation of CD4 lymphocytes counts reveled significant rise during time of anesthesia (42.23pg/ml), however they showed significant reduction post-operatively (37.12pg/ml), but the reduction did not reach baseline count. In addition, the observation of CD8 lymphocytes counts reveled significant rise during time of anesthesia (28.21pg/ml), however it showed significant reduction post-operatively (22.91pg/ml), but the reduction did not reach baseline count. Serum levels of cytokine IL-2 were higher post-operative (1257.7pg/ml), and lower levels were seen with IL-10 mainly pre-operative (36.08pg/ml). However, levels of interleukin-2 and interleukin-10 showed no significant changes in relation to time of anesthesia whether pre-, peri- or post-operatively (P>0.05).

Conclusion: There was no significant association between cytokines levels, IL-2 and IL-10, or CD4 and CD8 counts with type of anesthesia whether general, local or regional anesthesia (P > 0.05).

Key words: Anesthesia, adaptive immunity, IL-2, IL-10, CD4, CD8, flow cytometry, ELISA.

Introduction

Several drugs, including anesthetic agents, influence cytokines secretion. Opioids, inhalational agents, intravenous and local anesthetics have shown different effects on immune system and cytokine expression [1]. General anesthesia accompanied by surgical stress are considered to suppress immunity, presumably by directly affecting the immune system or activating the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system [2]. Surgical stress and general anesthesia may suppress natural killer and cytotoxic T cells and also activating sympathetic nervous system [3]. The T lymphocytes are divided into the following subsets: helper (Th1, Th2 and Th17), cytotoxic (CTL), regulatory (T reg) and memory (Tm) [4]. Clusters of differentiation have numerous physiological functions, which acts as receptors or ligands for signal cascade which lead to alter the cell’s behavior and its functions in cell adhesion [5]. Main function of CD4 is a co-receptor of the T cell receptor (TCR) and assists the latter in communicating with antigen-presenting cells, The CD8 molecule is a marker for cytotoxic T cell population [6]. The primary aim of this study was to evaluate the effects of different anesthesia techniques on cellular immunity in orthopedic patients.

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Materials and Method

This study was conducted on 30 patients with orthopedic surgeries and arthroscopy. They were divided into 16 males (53.3%) and 14 females (64.7%) with age range of 10-72 years old recruited from orthopedic and rheumatology departments at AL-Diwaniyah Teaching Hospital, Iraq, during the period from 1st January 2018 to the end of April 2018. Three types of anesthesia were used, 10 patients anesthetized with general anesthetics, 10 patients with regional anesthesia and the last 10 patients with local anesthesia with an average duration of anesthesia of 75 minutes (range from 15-90 minutes. The study population was assessed by a questionnaire regarding age, gender, type of surgery, duration of anesthesia and clinical history of other diseases.

Immunofluorescence: Kits of ELISA were used in this study depending on sandwich enzyme immunoassay method. Micro ELISA plate provided in this kit has been pre-coated with an antibody specific to (IL-2 and IL-10). Optical Density (OD) for each well was calculated at once by using a micro-plate reader spectrophotometer at wave length 450nm.

Flow cytometry: Flow cytometry assay kits that have been used in this study were Flow cytometry kit for CD4 Thermo Fisher/ Bioscience™ USA and Flow cytometry kit for CD8Thermo Fisher/ Bioscience™ USA.

Statistical analysis: Data were translated into a computerized database structure. An expert statistical advice was sought for. All data were analyzed using Statistical Package for Social Sciences (SPSS) software version 20 in association with Microsoft Excel 2016. To measure the strength of association between categorical variables such as the effect of anesthetic techniques on cellular response, the odds ratio (OR) was used.

Results

According to type of anesthesia used, this study enrolled 10 patients with general anesthesia, 10 patients with regional anesthesia and 10 patients with local anesthesia. The mean duration of anesthesia was 44.33±19.85 minutes and it ranged from 15-90 minutes. Hypertension was seen in 3 patients (10%), diabetes was seen in 3 patients (10%) and ischemic heart disease (IHD) was seen in one patient (3.3%). Also, one patient (3.3%) suffered from asthma and agranulocytosis was seen in another patient (3.3%), (Table 1).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>30</td>
</tr>
<tr>
<td>Age/ year</td>
<td></td>
</tr>
<tr>
<td>Mean±SD*</td>
<td>35.67±17.53</td>
</tr>
<tr>
<td>Range (Min.-Max.)</td>
<td>10-72</td>
</tr>
<tr>
<td>Gender/ No.(%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16(53.3)</td>
</tr>
<tr>
<td>Female</td>
<td>14(46.7)</td>
</tr>
<tr>
<td>M:F ratio</td>
<td>1.14:1</td>
</tr>
<tr>
<td>Type of anesthesia/ No.(%)</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>10 (33.3)</td>
</tr>
<tr>
<td>Local</td>
<td>10 (33.3)</td>
</tr>
<tr>
<td>Regional</td>
<td>10 (33.3)</td>
</tr>
<tr>
<td>Duration of anesthesia/ minute</td>
<td></td>
</tr>
<tr>
<td>Mean±SD</td>
<td>44.33±19.85</td>
</tr>
<tr>
<td>Range (Min.-Max.)</td>
<td>15-90</td>
</tr>
<tr>
<td>Chronic illness/ No.(%)</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>3(10)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>3(10)</td>
</tr>
<tr>
<td>IHD</td>
<td>1(3.3)</td>
</tr>
<tr>
<td>Asthma</td>
<td>1(3.3)</td>
</tr>
<tr>
<td>Agranulocytosis</td>
<td>1(3.3)</td>
</tr>
</tbody>
</table>

The highest level of cytokine was for IL-2, mainly post-operative, with a median level of (1257.7pg/ml) and the lowest level was seen with IL-10, mainly pre-operative, with a median level of (36.08pg/ml). Despite that, the levels of both cytokines showed no significant change in relation to time of anesthesia whether pre-, peri- or post-operative (P>0.05; Figures 1 and2). Tables 2 and 3 showed that there is no significant association between cytokines serum levels (pre-, peri- and post-operatively) with participants’ gender and age (P>0.05; Tables 2 and3). In addition, analysis of current data revealed no correlation between serum cytokines levels and type of anesthesia i.e. general, local or regional anesthesia (P>0.05; Table 4). showed no significant
association between these cytokine level and type of anesthesia (P > 0.05), as described in table (4). Considering the time of duration of anesthesia, the result revealed there is no significant association between cytokines level and duration of anesthesia as in table (5).

**Table 2 Association of serum cytokines levels with participants’ gender**

<table>
<thead>
<tr>
<th>Cytokine</th>
<th>Male (n=16)</th>
<th>Female (n=14)</th>
<th>P *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>IQR</td>
<td>Median</td>
</tr>
<tr>
<td>IL-2 pre</td>
<td>1142.10</td>
<td>891.23</td>
<td>1148.90</td>
</tr>
<tr>
<td>IL-2 peri</td>
<td>1225.10</td>
<td>413.64</td>
<td>973.38</td>
</tr>
<tr>
<td>IL-2 post</td>
<td>1274.10</td>
<td>300.02</td>
<td>1110.80</td>
</tr>
<tr>
<td>IL-10 pre</td>
<td>36.08</td>
<td>38.07</td>
<td>36.81</td>
</tr>
<tr>
<td>IL-10 peri</td>
<td>37.06</td>
<td>22.89</td>
<td>45.19</td>
</tr>
<tr>
<td>IL-10 post</td>
<td>48.56</td>
<td>32.75</td>
<td>39.55</td>
</tr>
</tbody>
</table>

* Significant only at P≤0.05.

**Table 3 Correlation between serum cytokines levels and participants’ age**

<table>
<thead>
<tr>
<th>Cytokine</th>
<th>r</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>LogIL-2 pre</td>
<td>-0.124</td>
<td>0.515</td>
</tr>
<tr>
<td>LogIL-2 peri</td>
<td>0.128</td>
<td>0.501</td>
</tr>
<tr>
<td>LogIL-2 post</td>
<td>0.149</td>
<td>0.434</td>
</tr>
<tr>
<td>LogIL-10 pre</td>
<td>-0.082</td>
<td>0.666</td>
</tr>
<tr>
<td>LogIL-10 peri</td>
<td>0.140</td>
<td>0.461</td>
</tr>
<tr>
<td>LogIL-10 post</td>
<td>0.051</td>
<td>0.788</td>
</tr>
</tbody>
</table>

* Significant only at P≤0.05. r: Correlation coefficient.

**Table 4 Correlation between serum cytokines levels and type of anesthesia**

<table>
<thead>
<tr>
<th>Cytokine</th>
<th>GA</th>
<th>LA</th>
<th>RA</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>IQR</td>
<td>Median</td>
<td>IQR</td>
</tr>
<tr>
<td>IL-2 pre</td>
<td>1064.50</td>
<td>998.72</td>
<td>1448.20</td>
<td>491.88</td>
</tr>
<tr>
<td>IL-2 peri</td>
<td>905.34</td>
<td>597.33</td>
<td>1291.80</td>
<td>797.34</td>
</tr>
<tr>
<td>IL-2 post</td>
<td>1226.50</td>
<td>392.55</td>
<td>1406.10</td>
<td>408.87</td>
</tr>
<tr>
<td>IL-10 pre</td>
<td>35.00</td>
<td>34.81</td>
<td>36.41</td>
<td>33.40</td>
</tr>
<tr>
<td>IL-10 peri</td>
<td>32.07</td>
<td>15.68</td>
<td>42.92</td>
<td>14.43</td>
</tr>
<tr>
<td>IL-10 post</td>
<td>35.98</td>
<td>46.69</td>
<td>38.79</td>
<td>20.44</td>
</tr>
</tbody>
</table>

GA: General Anesthesia. LA: Local Anesthesia. RG: Regional Anesthesia. * Significant only at P≤0.05.
Table 5 Correlation between serum cytokines levels and duration of anesthesia

<table>
<thead>
<tr>
<th>Cytokine</th>
<th>r</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log IL-2 pre</td>
<td>-0.223</td>
<td>0.236</td>
</tr>
<tr>
<td>Log IL-2 peri</td>
<td>-0.078</td>
<td>0.681</td>
</tr>
<tr>
<td>Log IL-2 post</td>
<td>0.105</td>
<td>0.581</td>
</tr>
<tr>
<td>Log IL-10 pre</td>
<td>0.142</td>
<td>0.454</td>
</tr>
<tr>
<td>Log IL-10 peri</td>
<td>-0.079</td>
<td>0.678</td>
</tr>
<tr>
<td>Log IL-10 post</td>
<td>0.046</td>
<td>0.809</td>
</tr>
</tbody>
</table>

*Significant only at $P \leq 0.05$. $r$: Correlation coefficient.

Observation of CD4 lymphocytes counts revealed significant rise during time of anesthesia (42.23pg/ml), however it showed significant reduction post-operatively (37.12pg/ml), but the reduction did not reach baseline count. In addition, the observation of CD8 lymphocytes counts revealed significant rise during time of anesthesia (28.21pg/ml), however it showed significant reduction post-operatively (22.91pg/ml), but the reduction did not reach baseline count. Table (6) showed that the count of CD4 lymphocytes and CD8 lymphocytes pre-, peri- and post-operatively did not show significant association with gender ($P > 0.05$). Also, CD4 and CD8 lymphocytes did not show significant correlation with age of patients ($P > 0.05$).

Table 6 Lymphocytes immune markers in relation to participants’ gender

<table>
<thead>
<tr>
<th>Marker</th>
<th>Total (n = 30)</th>
<th>Males (n = 16)</th>
<th>Females (n = 14)</th>
<th>P*†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>IQR</td>
<td>Median</td>
<td>IQR</td>
</tr>
<tr>
<td>CD4Pr</td>
<td>32.62</td>
<td>7.80</td>
<td>35.84</td>
<td>6.79</td>
</tr>
<tr>
<td>CD4Pe</td>
<td>42.23</td>
<td>17.08</td>
<td>46.10</td>
<td>17.49</td>
</tr>
<tr>
<td>CD4Po</td>
<td>37.12</td>
<td>15.11</td>
<td>37.12</td>
<td>16.09</td>
</tr>
<tr>
<td>CD8Pr</td>
<td>19.62</td>
<td>7.67</td>
<td>20.87</td>
<td>6.54</td>
</tr>
<tr>
<td>CD8Pe</td>
<td>28.21</td>
<td>12.18</td>
<td>29.48</td>
<td>7.75</td>
</tr>
<tr>
<td>CD8Po</td>
<td>22.91</td>
<td>12.40</td>
<td>25.93</td>
<td>14.92</td>
</tr>
</tbody>
</table>

*Significant at $P \leq 0.05$. SD: standard deviation.† Mann Whitney U test.

Figure 1 Serum level of IL-2 in relation to time of anesthesia.

† Friedman test; CD: Cluster of designation; IQR: inter-quartile range.
Figure 2 Median serum levels of immune markers in relation to operation timeline.

Discussion

The present study showed that the level of cytokines (IL-2 and IL-10) became significantly higher during operation, whatever the type or duration of anesthesia, in comparison with their levels before operation and that their levels continued to rise insignificantly after operation, however, they did not return back to their levels before operation. The findings of our study may be attributed to surgical stress that enhances a number pro-inflammatory mediators such as IL-2, produced by inflammatory cells, which then activate hypothalamic-pituitary-adrenal axis, thereby pro- and anti-inflammatory cytokines and neuro-hormonal system and additively potentiate their abortive effect on the immune system. These results were in agreement with [7-10]. Some authors suggested that use of opioids may cause a rise in IL-10 by a receptors-mediated mechanism (µ receptors) on the cell surface of macrophages and lymphocytes. These receptors when activated lead ultimately to increased secretion of anti-inflammatory mediator (IL-10) by certain intracellular mechanism(s) that is unclear till now [11]. The current study showed no significant correlation between any of the cytokines and gender of patients. This finding was in agreement with [12, 13]. This indicated that gender of patients had nothing to do with the level of inflammatory cytokines. An explanation for this finding could be that the main difference between males and females is represented by certain hormonal levels, namely estrogen, progesterone and testosterone, and these hormones have no effects on the level of inflammatory mediators [14]. The current study showed no significant correlation between any of the cytokines and age of patients. This was most likely due a relatively small sample size; however, substantial amount of published literature documented the negative correlation between age and immune markers due to the concept of aging of immune system [15]. Moreover, current study showed no significant correlation between any of the cytokines and duration of anesthesia. The most likely explanation is that the trigger for the rise in cellular counts and immune markers is tissue injury produced by surgical operation and so once tissue injury supervenes, levels of these markers change regardless of duration of anesthesia [10]. Furthermore, current study showed no significant correlation between any of the cytokines and type of anesthesia. Surgical trauma results in a metabolic, hemodynamic, endocrine and immune reaction that continue for a minimum of several days [10].

The present study showed that the level of immune markers, CD4 and CD8 became significantly higher during operation, whatever the type or duration of anesthesia, in comparison with their levels before operation and that their levels decreased significantly after operation, however, they did not return back to their levels before operation. These findings were in agreement with [17,18]. The increase in levels of CD4 and CD8 lymphocytes could be attributed to an increase in levels of cytokines and pro-inflammatory mediators in response to stress accompanying surgical operation that is the mirror of humeral and neural stimulation. The rise in cytokines certainly will cause an increment in CD4 and CD8 lymphocyte counts. In the present study, there was no significant correlation between gender and immune markers (CD4 and CD8) and these results were in agreement with [19,20]. The explanation for these findings is that the main difference between males and females is represented by certain hormonal levels and these hormones have no effect on the count of immune cells [21]. Moreover, in the present study, there was no significant correlation between age and immune markers (CD4 and CD8) and these results were in agreement with [20], but disagreed [15]. This finding may be due to a relatively small sample size. In the present study, there was no significant correlation between age and immune markers (CD4 and CD8) and these results were in agreement with [22]. In addition there was no significant correlation between type anesthesia and immune markers (CD4 and CD8) and these results were in agreement with [12,20].

Conclusions

Primarily, there is no significant effect of anesthesia on immune response in patients undergoing orthopedic
operations. In addition, changes in cells counts, immune markers and cytokines were mainly attributable to tissue trauma during operation that is mediated by neuro-humoral responses.

**Ethical Clearance:** Obtained from the Research Ethics Committee at AL-Qadisiyah Health Directorate, Diwaniyah City, Iraq.

**Source of Funding:** Self-funded.

**Conflict of Interest:** Nil

**References**


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Evaluation of Tuberculosis Skin Test in Al-Hilla Province

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¹Department of Internal Medicine, University of Babylon, Iraq, ²College of Hammurabi, University of Babylon, Iraq, ³FICMS (med), FICMS (rasp), Ministry of Health, Iraq

Abstract

The accurate diagnosis of latent tuberculosis infection (LTBI) is an important component of any tuberculosis control programme and depends largely on tuberculin skin testing. The appropriate interpretation of skin test results requires knowledge of the possible confounding factors such as previous BCG vaccination. This study aimed to assess tuberculin skin testing in patient with latent tuberculosis infection.

The study was performed at Tuberculosis Centre in Babylon Province in the period from February 2016 to February 2017, it included 1109 patients.

History and physical examination were performed, the history included information about age, gender, address, history of contact with tuberculosis patients, and history of BCG vaccination. Tuberculin skin test was performed by mantoux test, 0.1 unit of purified tuberculin protein injected intra-dermally and read after 48 hours, the result was measured in millimeter (mm).

The age ranged from 1-85 years and the mean age was 24.30±20.241, percentage of females was more than males (52% versus 48%), the number of positive cases of BCG were 966 (87%) while the negative cases was 143 (13%), the number of positive cases of tuberculin skin test was 86 (7.8%) while the negative cases were 1023 (92.2%). The diameter of skin test was higher in vaccinated subjects than non-vaccinated and the result was significant (p value=0.004). The number of positive skin test was higher in vaccinated than non-vaccinated patients and the difference was significant.

In subjects without active tuberculosis, immunization with BCG largely increases the likelihood of a positive tuberculin skin test. The interpretation of the skin test therefore needs to be made in the individual clinical context and with evaluation of other risk factors for infection. The size of the induration should also be considered when making recommendations for treatment of latent infection.

Keywords: Tuberculosis, tuberculin skin test, latent tuberculosis infection

Introduction

Tuberculosis (TB) is caused by Mycobacterium tuberculosis (MTB) and is one of the deadliest infectious diseases worldwide. Despite recent progress in molecular diagnosis and effective medications, its morbidity and mortality remain high. The World Health Organization (WHO) reported that 8.7 million people developed active TB in 2011 and 1.4 million people died from it¹. Meanwhile, one-third of the world’s population is estimated to be infected by MTB. Latent TB infection (LTBI) is defined by evidence of immunological responses by Mycobacterium tuberculosis (MTB) proteins in the absence of clinical symptoms/signs of active diseases². An estimated 30% of the people exposed to MTB will have evidence of LTBI by tuberculin skin test³. Therefore, identifying and sterilizing latently infected individuals, especially those at high risk, are of paramount importance for eliminating TB⁴.

Compared to numerous reports on active TB, disparities between sexes in LTBI are less frequently analyzed and have inconsistent findings. Male sex has been identified as an independent risk factor associated with LTBI in some studies⁵,⁶,⁷. Infection with Mycobacterium tuberculosis can result in latent tuberculosis infection (LTBI) or active tuberculosis (TB)⁸. The progression of LTBI to active TB can be
reduced by up to 90% with nine months of preventive treatment. The World Health Organization has identified that better identification and treatment of those with LTBI who are at higher risk of progressing to active TB is integral to the new TB elimination goals.

This study aimed to assess tuberculin skin testing in patients with latent tuberculosis infection.

Materials and Method

The study was performed at Tuberculosis Centre in Babylon Province in the period from February 2016 to February 2017, it included 1109 patients, history and physical examination were performed, the history included information about age, gender, address, history of contact with tuberculosis patients, and history of BCG vaccination. Tuberculin skin test was performed by mantoux test, 0.1 unit of purified tb protein injected intra-dermally and read after 48 hours, the result was measured in millimeter (mm).

Statistical Analysis

The data were analyzed by using SPSS version 18, descriptive analysis was used for demographic data, cross tabulation was used for finding relation between different variables, p value less than 0.05 was considered statistically significant.

Results

The age ranged from 1-85 years and the mean age was 24.30±20.241, percentage of females was more than males (52% versus 48%) (Table 1).

Table 1. Demographic data

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) (Mean ± SD)</td>
<td>24.30±20.241</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Males/ no. (%)</td>
<td>537 (48%)</td>
</tr>
<tr>
<td>Females/ no. (%)</td>
<td>572 (52%)</td>
</tr>
<tr>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>569 (51 %)</td>
</tr>
<tr>
<td>Urban</td>
<td>540 (49%)</td>
</tr>
</tbody>
</table>

Table (2) shows that the number of positive cases of BCG were966 (87%) while the negative cases was 143 (13%) (Table 2).

Table 2. Frequency of BCG cases

<table>
<thead>
<tr>
<th></th>
<th>No. (%)</th>
<th>Total No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG positive</td>
<td>966 (87%)</td>
<td>1109 (100%)</td>
</tr>
<tr>
<td>negative</td>
<td>143 (13%)</td>
<td></td>
</tr>
</tbody>
</table>

Table (3) shows that the number of positive cases of tuberculin skin test was 86 (7.8%) while the negative cases were 1023 (92.2%)

Table 3. Distribution of tuberculin skin test results

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>1023</td>
<td>92.2</td>
</tr>
<tr>
<td>Positive</td>
<td>86</td>
<td>7.8</td>
</tr>
<tr>
<td>Total</td>
<td>1109</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The diameter of skin test was higher in vaccinated subjects than non-vaccinated and the result was significant (p value=0.004).

The number of positive skin test was higher in vaccinated than non-vaccinated patients and the difference was significant (Figure not shown) (p=0.039).

The percentage of positive skin test in non-contact individuals was higher than contact subjects (Figure not shown) and the result was significant (P=0.002).

Discussion

For the purpose of identifying latently infected individuals in the laboratory, two associated factors (place of birth in a foreign country with a high prevalence of tuberculosis and history of exposure to patients with untreated active tuberculosis) are useful preselection criteria before performing tuberculin skin testing.

The present revision is regarded the first population-based investigation inspecting the epidemiology of tuberculosis infection in Hilla province in one year and the first revision ever to survey LTBI by using TST in a population-based sample.

The age ranged from 1-85 years and the mean age was 24.30±20.241, percentage of females was more than males (52% versus 48%) due to the females visiting the
health care assurance were higher than males and this agrees with a study performed by al-Kassimi et al., 1993. The numbers of positive tuberculin skin test were higher in younger age group (1-55) years than age-group (> 56 year) and this was consistent with a previous studies like Al-Jahdali et al., 2005 and Ayubi et al., 2015, and the probable higher waning of the T-cell mediated immune response to TST in older age. The percentage of positive skin test was more in females than males (p=0.006) which may be due to the cases for our study was females more than males and this result was different from a studies performed by13,14,15

Vaccination with bacillus Calmette-Guérin (BCG) has been used for the prevention of tuberculosis (TB) in humans since 1921; approximately 100 million doses per year are administered to children in 170 countries of the world4. BCG vaccine is thought to be effective in preventing or ameliorating severe complications of TB in children, i.e., disseminated disease or meningitis, but is of marginal efficacy in preventing adult forms of TB5,6. The occurrence of a higher conversion rate among those individuals with a BCG scar might indicate true conversion due to recent infection than a boosting effect of BCG since these individuals were TST negative at enrollment6.

In one study, the researchers found that in teenagers who had received one BCG vaccination at birth, 10 mm of induration was the most sensitive and specific cutoff for the development of TB, whereas in those who had been revaccinated, 16 mm was more predictive7 and this is conflu ent with our results. Table (2) shows that the number of positive cases of BCG was 966 (87%) while the negative cases was 143 (13%). The diameter of skin test was higher in vaccinated subjects than non-vaccinated and the result was significant (p value=0.004). The number of positive skin test was higher in vaccinated than non-vaccinated patients and the difference was significant (p=0.039).

Conclusion

The data presented here will contribute to the efforts made to control and prevent TB infection by increasing the awareness of latent TB infection, conversion rates, and the problems related to the TST

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

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Innovation Technology: Multi Drug Resistance Bacteria Threaten our Future: Effect of the Zn, Zr nps and Magnetic Water on the Biofilm Formation in Some Bacterial Isolates from Burn Patients in Baghdad Hospital

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¹College of Sciences Mustansiriyah University, Iraq, ²Ibn Alhaytham Education College, University of Baghdad, Iraq

Abstract

Introduction: Biofilm considered a challenge to control infectious bacteria, which encourage to establish an alternative invention treatment to control disease. Application of nanotechnology showed an effective agent to control biofilm producing bacteria. Now a days Magnetised water (MW) raises a significant attention to control infectious disease and improve human health in general.

Total of 40 burn swabs collected from burn unit Baghdad hospital were tested. 19 bacterial isolates (Acinetobacter baumannii, streptococcus epidermidis and pseudomonas aeruginosa) were identified by microscopic examination and Vitech system. Firstly, Congo red agar method and Microtitre plate method were performed to assess the effect of Zinc (Zn) and zirconium (Zr) nps on biofilm. A different con. (50,100,150 mg/ ml) of Zn and Zr nps were investigated. Secondly, 100Ml of magnetic water (MW) (350 gauss/h) to investigate the effect of (MW) on biofilm inhibition using Microtitre plate method.

Streptococcus epidermidis has a highly resistance towards a Zn and Zr nps in comparison to Acinetobacter baumannii and Pseudomonas aeruginosa While the MW results showed a significant inhibition effect on all bacterial isolates.

Due to the raising, a risk of bacterial drug resistance, employing an alternative innovation technology such as nanotechnology and MW might be the near future application to control infectious disease.

Keywords: Biofilm, nanoparticles, magnetic water

Introduction

The development of multi-drug resistant organisms with complicated burn infections may be a potential risk. Colonization and infection of inwards patients are a serious clinical problem, which causing a serious threatening on patients health in addition to expensive treatment cost¹.

Innovation strategy that is gaining attention for combating the threat of bacterial infection and preventing wound sepsis, is the use of novel metal antimicrobial agent. For centuries, zinc well-known bactericidal properties². The development of novel bacterial resistance mechanisms encourages scientific community to invent an alternatives antimicrobial agent. The use of inorganic nanoparticles has advanced rapidly³,⁶. Metal oxide materials, such as CuO, TiO₂, ZnO, and MgO, have recognized as antibacterial agents⁴,⁵.⁶.

Nano-scale materials have emerged as novel antibacterial agents due to their high surface area to volume ratio and unique chemical and physical properties⁷. In addition, nanometal such as zirconium (Zr) oxide nanoparticles have released wide opportunities for applications in drug delivery, as well as for protein
encapsulation. Zr compounds are biocompatible and exhibit low toxicity. Literature reported that Zr nps coated textiles are widely used for hygienic clothing, wound healing, and medical applications in hospitals highly hygienic areas. Researcher have reviewed developing a new method for enhancing antimicrobial and wound healing using the Zr nps coated bandages.

Water influenced by a magnet undergoes certain physical and chemical changes. Its physical properties like center of crystallization, pH value and nitrogen dissolving capacity are altered. It has been reported the (MW) Magnetized water improves digestion, reduces acidity, acts like a diuretic and dissolves kidney stones. It also has therapeutic effects in burns, cuts and wounds. Its molecules found to have positive effects on the functioning of the nervous system.

The aim of this study is to camper the effect metallic nanoparticles and magnetic water on the ability of bacterial biofilm production.

Materials and Method

Sample collection and identification of Bacterial strains

All chemicals, culture medium and broth used purchased from Himedia, India. Depending on the manufacturers’ instruction, the media included blood agar (Oxoid), MacConkey agar, Mueller Hinton agar, Mueller Hinton broth, and Mannitol salt agar.

Collection of specimens and bacterial identification

Total of 40 Burn swabs collected from patients in burn unit Baghdad hospital. Sterile swabs collected from patients suffering from burn infections, swabs transported as quickly as possible to the laboratory. Bacterial isolates cultured on Blood agar, mannitol salt agar and MacConkey agar. Isolate identified by microscopic, and biochemical tests according to. The isolates were confirmed by burn unite Baghdad hospital where Vitech system being involved for bacterial species detection.

Antibiotics susceptibility test

Bacterial sensitivity test

The susceptibility of antibiotics was carried out using disc-diffusion method on Muller-Hinton agar. All petri dishes incubated for 24 h at 37°C. Inhibition zone (IZ) of grown bacterial recorded. Bacterial isolates were tested with different antibiotics as below:

- Amoxicillin-clavulanic acid, Bacitracin, Cefepime, Cefotaxime, Ceftazidime, Cefoxitin, Ceftriaxone, Ciprofloxacin, Erythromycin, Imipenem, Methicillin, Nalidixic acid, Nalidixic acid, Nitrofurantion, Rifampin, Trimethoprim.

Minimal inhibition concentration and Antibiotic sensitivity test

Different standard antibiotics were associated to test the susceptibility of each bacterial isolates for the specified antibiotics such mentioned above. An antibiotic sensitivity test was done using disc diffusion method. The diameter of (IZ) measured via a calliper and recorded. Bacterial isolates were categorized as resistant (R) or sensitive (S) according to.

Biofilm formation assay

All isolates were subjected to biofilm production. Via following the method below:

1. Congo red agar method

Qualitative evaluation of biofilm producers using the Congo red agar method to detect slime production was performed as follows: The medium is comprised of brain heart infusion broth (Hi media /India) 37 g/L, sucrose (BDH / England) 50 g/L, Congo red (Fluka) 0.8 g/L and agar (Biolife /Italy) 10 g/L. Inoculated plates were incubated at 37°C for 24 hr. Slime producing strains presented black colonies while non-producing strains developed red colonies.

2. Microtitre plate method

Studied bacterial isolates cultured in Brain Heart Infusion (BHI) broth (Hi media /India) incubated at 37°C for 18 hours, after that bacterial culture was diluted in BHI broth and adjusted in comparison to MacFarland tube no. 0.5. 200Ml bacterial culture was used to inoculate pre-sterilized 96-well polystyrene Microtiter plates and incubated for 48 h for 37°C. After incubation, all wells were washed with sterile physiological saline to remove unattached cells. Afterward, 200µl of 1% crystal violet was added to each well at room temperature. Wells rinsed with 200 µl sterile saline. This process was
replicated three times.

About 200μl of ethyl alcohol were involved to remove the excessive stain (crystal violet) bounded to the biofilm. The absorbance of microliter plate was determined at 540nm using an ELISA reader (Human/German). Controls were performed with crystal violet binding to the wells exposed only to the culture medium without bacteria. All the assays were performed in triplicates.

The cut-off optical density (ODc) for the microtitre-plate is defined as three standard deviations above the mean OD of the negative control. Strains were classified as follows: OD ≤ ODc non-adherent, ODc < OD ≤ 2 x ODc weakly adherent, 2 x ODc < OD ≤ 4 x ODc moderately adherent, 4 x ODc < OD strongly adherent).

Effect of Nps on different bacterial species biofilm

Biofilm inhibition carried out in 96 wall plates adopting the modified method of biofilm inhibition spectrophotometric assay as mentioned above. (50, 100, 150 mg/ml) (Zn and Zr ) nps added to biofilm containing wells to estimate the effect of nps on viability of biofilm production in many bacterial isolates Subsequently, the tray was incubated for another 24 hours at 37°C. All wells were washed and stained as procedure described by12,19,20,21.

Effect of magnetic water on different bacterial species biofilm

The Magnetic water preparation inside Department of Physics – College of Education-Ibn Al Haitham. and so exposing distilled water to the intensity of a magnetic field of 350 gauss for one hour, after which the surface tension as an indicator of the expense of having become magnetized water (Figure 1).

Results and Discussion

Bacterial Isolates

Total of 40 swabs collected from inward patients in Baghdad teaching hospital who has been diagnosed as a burn patients. 19 samples were positive for microorganisms, whereas 1 was negative.

A total of 20 bacterial isolates (Acinetobacter baumannii, Streptococcus epidermidis and Pseudomonas aeruginosa) was found, including 14 Gram-negative and 5 Gram-positive bacterial isolates. (10). Acinetobacter baumannii, followed by (5) Streptococcus epidermidis isolates And only 4 Pseudomonas aeruginosa (Figure 2).
It is obvious the Acinetobacter baumannii, is dominate bacterial spp. which has isolated form burn patients, as a 10 isolated were collected and diagnosed, followed by streptococcus spp. which recorded 5 spp. Lastly, only 4 of Pseudomonas aeruginosa has been registered form these burn patients.

The current data comes agreed with [21] Pseudomonas aeruginosa and one of Streptococcus epidermidis isolated form burn patients. Dominant bacteria were Klebsiella spp 36 (18.5%) followed by Pseudomons aeruginosa 19 (9.7%), Staphylococcus epidermidis 4(2.1%) while results of this study comes slightly different to Colonization of Burn Wounds15.

**Antibiotics susceptibility test**

Antibiotic susceptibility carried out using disc-diffusion method on Muller-Hinton agar. Table 1 showed the antibiotic sensitivity test for the bacterial isolates. Hammoudi (2009) has reported that Antibiotic susceptibility pattern for Pseudomonas aeruginosa isolates have shown high sensitivity for Amikacin 30(85.0%), Pipracillin-Tazobactam 27(77.2%) Piperacillin 25(71.4%), Ciprofloxacin 25(71.4%) and Colistin 24(68.5%) and low susceptibility for Tobramycin 20(57.2%) Gentamycin 18 (51.0%). Data revealed Pseudomonas aeruginosa resistant to most of the therapeutic agent in use in this experiment.

**Table 1. the percentage of sensitive(S) and Resistance ® bacterial spp. toward antibiotics**

<table>
<thead>
<tr>
<th>Antibiotic disc</th>
<th>A. baumannii (10)</th>
<th>St. empidermits (5)</th>
<th>P. aeruginosa (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R%</td>
<td>S%</td>
<td>R%</td>
</tr>
<tr>
<td>Amoxicillin-clavulanic acid</td>
<td>AMC</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Bacitracin</td>
<td>B</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Cefepime</td>
<td>FEP</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>CTX</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>CAZ</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>FOX</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>CRO</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>CIP</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>E</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>
Cont. Table 1. the percentage of sensitive(S) and Resistance ® bacterial spp. toward antibiotics

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Symbol</th>
<th>0</th>
<th>100</th>
<th>0</th>
<th>100</th>
<th>75</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imipenem</td>
<td>IPM</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>Methicillin</td>
<td>ME</td>
<td>100</td>
<td>0</td>
<td>_</td>
<td>_</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Nalidixic acid</td>
<td>NA</td>
<td>_</td>
<td>_</td>
<td>100</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrofurantion</td>
<td>F</td>
<td>100</td>
<td>0</td>
<td>25</td>
<td>75</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td>Rifampin</td>
<td>RA</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>TMP</td>
<td>40</td>
<td>60</td>
<td>50</td>
<td>50</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

Effect of ZN and Zr Nps on the biofilm formation

Well diffusion method was performed to investigate the antimicrobial activity of Zn and Zr nps. as mentioned above (Figure 3). It is obvious that there are a significant effect on biofilm formation rate with a little various depending to nps concentrations. Results showed that isolate no. (2, 7and 8) have significant resistance to Zn nps treatment, while it is clear that isolates no. 3, 4 and 9 were biofilm inhibited A. baumannii. *Streptococcus epidermidis* showed a highly resistance for the Zn Nps, in comparison to *Ps. aeruginosa* which revealed a slightly sensitivity to Zn nps treatment (Figure 3). However, the picture was different with Zr nps treatment at same condition. Data showed that isolates No. (1,4,6,7and 9) for A. baumannii showed a significant resistance for Zr nps while *Streptococcus epidermidis* was a slightly sensitive to Zr. In comparison to *Ps. aeruginosa* followed the same pattern wit Zn nps. (Figure 4). This results come agreed with [22] who has confirmed that Zn nps has an effective effect on different isolates of gram negative and gram positive bacteria.

Figure 3. Effect of Zn nps (50, 100, 150 mg/ml) on biofilm formation A. *A. baumannii*, B. *Streptococcus epidermidis* and C. *Ps. aeruginosa* bacterial isoaltes

Figure 4. Effect of Zr nps (50, 100, 150 mg/ml) on biofilm formation A. *A. baumannii*, B. *Streptococcus epidermidis* and C. *Ps. aeruginosa* bacterial isoaltes
Effect of magnetic water on the biofilm formation

Plate method used to assess the effect of MW on biofilm production of bacterial isolates (A. baumannii, Streptococcus epidermidis and Ps.aeruginosa). As mentioned above. Data showed a significant effect for the (MW) on the biofilm formation in different bacterial isolates. Result revealed that isolates no. (2, 7, 8 and 10) A. baumannii and Streptococcus epidermidis were resistance to treatment with MW. However, Ps.aeruginosa were very response to treatment with MW (figure 5).

Figure 5. Effect of MW on biofilm formation A. A. baumannii, B. Streptococcus epidermidis and C. Ps.aeruginosa bacterial isoaltes.

Results after exposure to MW found that bacterial isolates lost ability of biofilm formation, Were exposed to magnetic water of different volume and different times, Ps. aeruginosa exposure to MW showed a highly resistance of bacteria to treatment and its ability to produce biofilm.

Conclusion

In conclusion, ZnO-NPs can exhibit broad-spectrum biocide activity towards multiple drug resistant strains of bacteria. However, antibacterial effects, safety, and detailed mechanisms of zinc oxide nanoparticles should be further studied in vitro and in vivo. MW showed a significant effect on the reducing the biofilm formation in different bacterial isolates.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

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References


Unilateral Approach to Decompress the Lumbar Spine Stenosis by Laminotomy and Undercutting of the Lamina; Short-Term Clinical Outcome

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Abstract

Lumbar spinal stenosis (LSS) is a very common problem that affects the lumbar spine in people over the age of 55 years and surgery is required with increasing frequency. It is defined as buttock or lower extremity pain due to narrowing in the space available for the neural and vascular elements in the lumbar spine. Aim of study: To evaluate prospectively the outcome and efficacy of decompression for LSS through unilateral approach by undercutting the stenotic elements.

This prospective study included 28 patients treated surgically in Al-Diwaniyiah Teaching Hospital from October 2015 to October 2017 who suffering from back pain, leg pain and neurogenic claudication due to degenerative LSS, clinical outcome was measured using visual analogue scale (VAS) and Oswestry disability index (ODI). Finally modified Macnab criteria were used to determine functional improvement for all patients at the time of their last follow up.

At the time of final follow up, all patients were satisfied with their treatment. The mean±SD for their pre-operative (VAS) and (ODI) improved after the operation. Where these improvements were statistically significant with P-value of <0.001.

This approach is an efficient surgical procedure to relieve symptoms of LSS by achieving sufficient decompression of the cord and roots with preservation of the posterior spinal elements.

Keywords: Lumbar spine stenosis, unilateral approach, decompression,

Introduction

LSS is a degenerative condition in which changes in the discs, ligamentum flavum, and facet joints with aging cause narrowing of the spaces around the neurovascular structures of the spine. Spinal canal (central), lateral recesses or intervertebral foramen (or a combination) causes compression of associated neurovascular structure. These changes lead to pain in the legs and back, as well as impaired ambulation and other disabilities. LSS typically manifests itself clinically in spinal claudication, a symptom complex including exercise-related pain in the back and sometimes radicular, but more often pseudoradicular radiation of pain into the lower limbs. Magnetic resonance imaging (MRI) of the lumbar spine is the standard procedure for the demonstration of stenosis and cauda equina compression. Computed tomography (CT) is recommended when MRI is contraindicated or unavailable. CT combined with myelography provides good visualisation of central and lateral recess stenosis. Conservative treatment does not alter the natural history of degenerative stenosis. The goal of surgery is to decompress the nerve roots, dura mater, and vessels without impairing segmental stability. The principles are to decompress all stenotic areas and levels, paying specific attention to the foramen, which is the commonest site of inadequate decompression.

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**Materials and Method**

This prospective study was conducted on (28) patients with degenerative LSS who underwent surgical decompression in AL-Diwania Teaching Hospital during the period from October 2015 to October 2017. Those patients were seen in the consultation clinic or in the private clinics. Of those (28) patients there were (16) male and (12) female. The followings Inclusion criteria were used; All patients had trial at least 6 months of conservative treatment, neurogenic claudication or radiculopathy, no previous surgery for lumbar stenosis or fusion, no pathology such diabetes, osteoporosis, instability and obesity and neuroimaging study shows degenerative LSS. Those included patients were complaining from backache, leg pain, radiculopathy, neurogenic claudication and functional disability. Twenty patient had MRI of lumbosacral spine at the time of presentation. Eight patients presented complaining of feature of LSS, they sent for MRI (Fig. 1).

![MRI sagittal ad coronal view of LSS.](image)

**Operative technique**

All patients were operated under general anesthesia in knee- chest position ,after shaving , sterilization and draping, the lumbar spine was approached depending on the level through a two – three inches midline incision. Lumbar fascia was incised and unilateral paraspinal muscle dissected off from the spinous process of the affected level, where its localization depend on the iliac crest and sacrum as anatomical landmarks. Under direct vision dissection was done to reach the affected intralaminar space and in some cases level above. We did intralaminar fenestration, the ligament flavum was removed piecemeal with Kerrison rongeour, laminotomy was done to uncover the proximal attachment of the ligamentum flavum. Then we did under cutting of the lamina from caudal part for exposure of the proximal attachment of the ligamentum flavum and widening of the central ring of the spinal canal. The thecal sac and nerve root retracted with nerve retractor to do undercutting of the facet joint to decompress the traversing and existing nerve root at the affected level.Sometimes we need to decompress the cranial part of the lamina, so in addition to mention above, we did undercutting of the lamina from cranial part at the level above. To decompress the other side we use curved kerrison to undercut the lamina as can as possible and excise the ligamentum flavum of the other side. The wound rinsed with saline. The incision was closed in layers. Negative drain used only in cases with multilevel stenosis. The operation time was 40-60 minute (Fig. 2 not shown).

Postoperatively the patient received standard postoperative management including pain management and prevention of postoperative infection with a third generation cephalosporin. The patient was confined to bed 12 hours after surgery then the patient was made to stand up and gradual walking was encouraged, no back support was used. Suture were removed after two week. All patients were advised a regular postoperative back exercise program after 4 weeks. Patient advised to return to original occupation after 6-12 weeks. All patients were assessed byVAS for their back and radicular pain,
and ODI for their functional disability at 1, 3, 6 months and one year posoperatively.

Statistical analysis

Descriptive statistic for continuous variable were expressed as mean ± SD, and for categorical variable as percentages. A paired student t-test was used to analyze data, (p <0.001) was statistically significant.

Results

A total of 28 patients were studied. The mean age of 28 patients was (59.28) years. The oldest in the group was 65 years and the youngest was 55 years. There were 12 female and 16 male. The mean duration of symptoms was (8.6) months. Ten patients presented with back pain, (12) patients presented with leg pain, six patients presented with intermittent claudication. Seven patients had comorbid conditions (hypertension). Thirty four levels in 28 patients were decompressed by this technique. Out of total, six patients had two level (L4 L5, L5 S1), 12 patients decompressed level was (L4 L5), six patients decompressed level was (L5 S1), and four patients (14.28%) decompressed level was (L3 L4) (Table 1).

Table 1. Patients signs and symptoms

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back pain</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>35.71%</td>
</tr>
<tr>
<td>Leg pain</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td>42.85%</td>
</tr>
<tr>
<td>Neurogenic claudication</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>21.41%</td>
</tr>
<tr>
<td>L4 L5</td>
<td>9</td>
<td>3</td>
<td>12</td>
<td>42.85%</td>
</tr>
<tr>
<td>L5 S1</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>21.42%</td>
</tr>
<tr>
<td>L4 L5 L5 S1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>21.42%</td>
</tr>
<tr>
<td>L3 L4</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>14.28%</td>
</tr>
</tbody>
</table>

Fortunately none of the known complications encountered in all patients. The average duration of surgery was 49.82 minutes. All patients were discharged 1st postoperative day. The final follow up for all patients was one year. The pain was assessed according to VAS. For all patients the preoperative mean ± SD VAS was 7.89 ± 1.64 which improved to 1.04 ± 0.92 postoperatively at one year, those with leg pain their preoperative mean ± SD VAS was 8.02 ± 0.82 which improved to 1.02 ± 0.01 postoperatively at one year and for patients with neurogenic claudication their the preoperative mean ± SD VAS was 7.66 ± 0.66 which improved to 1.24 ± 0.76 postoperatively at one year on scale of 0-10. The changes above were statistically significant (p<0.001) by using a paired student t-test (Table 2).

Table 2. Pre and post-operative VAS

<table>
<thead>
<tr>
<th></th>
<th>Preop. mean ±SD VAS</th>
<th>Postop 1 month</th>
<th>Postop. 3 month</th>
<th>Postop. 6 month</th>
<th>1 year postop.</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>7.89 ± 1.64</td>
<td></td>
<td></td>
<td></td>
<td>1.1 ± 0.56</td>
</tr>
<tr>
<td>Back pain</td>
<td>7.98 ± 1.64</td>
<td>3.86 ± 1.02</td>
<td>2.06 ± 0.88</td>
<td>1.66 ± 0.96</td>
<td>1.04 ± 0.92</td>
</tr>
<tr>
<td>Leg pain</td>
<td>8.02 ± 0.82</td>
<td>2.09 ± 0.2</td>
<td>2.02 ± 0.66</td>
<td>1.22 ± 0.04</td>
<td>1.02 ± 0.01</td>
</tr>
<tr>
<td>Neurogenic claudication</td>
<td>7.66 ± 0.66</td>
<td>3.82 ± 1.01</td>
<td>2.04 ± 0.84</td>
<td>1.66 ± 0.88</td>
<td>1.24 ± 0.76</td>
</tr>
</tbody>
</table>
The functional disability of all patients were assessed by ODI, the preoperative mean ± SD was 76 ± 12% and postoperative mean ± SD was 40 ± 16%, 26 ± 18%, 18 ± 14% and 12 ± 8 at one, three, six and one year respectively (Table 3) which show significant improvement (p.<0.001) (Table 4).

**Table 3. Pre and post-operative ODI**

<table>
<thead>
<tr>
<th></th>
<th>Preop. Mean±SD ODI</th>
<th>Postop. 1month</th>
<th>Postop. 3month</th>
<th>Postop.6 month</th>
<th>1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>76 ± 12 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain</td>
<td>74 ± 12</td>
<td>39 ± 16</td>
<td>28 ± 18</td>
<td>19 ± 14</td>
<td>14 ± 8</td>
</tr>
<tr>
<td>Leg pain</td>
<td>73 ± 12</td>
<td>42 ± 16</td>
<td>25 ± 18</td>
<td>17 ± 14</td>
<td>10 ±8</td>
</tr>
<tr>
<td>Neurogenic claudication</td>
<td>75 ± 12</td>
<td>41 ± 16</td>
<td>24 ± 18</td>
<td>18 ±14</td>
<td>12 ± 8</td>
</tr>
</tbody>
</table>

**Table 4. Pre and post-operative mean ODI and VAS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Preoperative mean</th>
<th>Postoperative mean</th>
<th>p. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td>7.88 ± 1.04</td>
<td>1.97 ± 0.67</td>
<td>p.&lt;0.001</td>
</tr>
<tr>
<td>ODI</td>
<td>76 ± 12 %</td>
<td>24% ± 15%</td>
<td>p.&lt;0.001</td>
</tr>
</tbody>
</table>

Functional improvement for all patients after one year postoperatively were assessed by using modified macnab criteria. According to these criteria 15 patients (53.57%) showed excellent results and 13 patients (46.42%) showed good results (Table 5).

**Table 5. Functional improvement**

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>9</td>
<td>6</td>
<td>15</td>
<td>(53.57%)</td>
</tr>
<tr>
<td>Good</td>
<td>8</td>
<td>5</td>
<td>13</td>
<td>(46.42%)</td>
</tr>
</tbody>
</table>

**Discussion**

Degenerative spinal stenosis is a progressive disease that commonly causes compression of the contents of the osteo-ligamentous vertebral canal and/or the intervertebral foraminal canal, particularly the neural structures. It is one of the most common spinal disorders affecting people older than 50 years of age in the poor strata of our society, because of the fact that most of them are labour and they are misusing their spine by heavy manual work. Therefore, year by year surgical treatment of LSS has been increased. For many years decompressive surgery has been the method of choice for those with progressive neurological symptoms. The most important factor in the success of decompression surgery for LSS is the preservation of the posterior elements. Laminectomy can cause destruction or impairment insufficiency of the pars interarticularis or facet joints, resulting in segmental instability and paravertebral muscle atrophy. Fenestration has been developed to solve this problem of laminectomy. This does not remove the midline osteoligamentous structure, preserves spinal stability but at the cost of limited access to the nerve tissues, leading to insufficient decompression in the lateral recesses. The potential risk for neural injury in a small working space is also a problem. Recently, instrumentation and the addition of fusion techniques for surgical decompression has become accepted.

The current studies suggested that preservation of the posterior spinal elements could minimize the risk of developing postoperative changes in spinal alignment.
and/or acceleration of disc and facet degeneration\textsuperscript{(11)}. Loss of the ligaments and spinous process makes the paraspinal muscles puny and compromises their function. Due to the loss of levers, the lumbar spine may not cope up with stress.

The osseous integrity and interspinous ligament play a vital role in maintaining the segment stability of the lumbar spine\textsuperscript{(14)}. Chen et al.\textsuperscript{(15)} in a cadaveric study, concluded that under flexion, the intervertebral displacement on the adjacent disc with a complete laminectomy was statistically larger than with an intact posterior osseous-interspinous ligament complex. Therefore, the integrity of the posterior complex acts as a tension band in flexion and helps stabilize the decompressed spine. On the other hand, the techniques in which there is wide retraction of the multifidus muscles bilaterally after their stripping for exposing the lumbar posterior elements, have potentially serious consequences/complications. Mayer et al.\textsuperscript{(16)} established that there is decrease in muscle strength, with associated atrophy on post-operative CT studies. Furthermore, the most devastating event leading to the stress response is tissue trauma, the greater the trauma, the greater the response and also extensive surgical tissue trauma results in delayed functional sequelae as well\textsuperscript{(16)}. Keeping all these facts and advancement in mind, we started this procedure in our department. In this procedure there were preservation of the spinous process and supraspinous/interspinous ligaments complex to avoid spinal instability, preservation of contralateral multifidus muscle attachments and less trauma to the tissue, by which can get lesser risk of multifidus denervation, less trauma response and reduces the potential complications like postoperative infection, cicatrization and scarring around the nerve and the dura mater by decreased dead space, that is why in the current study there is significantly better postoperative results regarding improvements in clinical outcomes. Also with this technique there are shorter surgical time, less blood loss, shorter length of hospital stay, shorter time to initiate mobilization, less narcotics use and fewer overall complications, will result in the continued lower costs associated with this technique. Furthermore this technique can provide increasing options to those patients who may not be the candidates for prolonge decompressive procedures. The development of minimally invasive techniques like microendoscopic decompression\textsuperscript{(17,18,19)} has led to safe and effective applications for decompression of LSS with the need for only a small-skin incision, minimal and gentle tissue dissection but symptomatic outcomes have remained similar or less profit than with conventional surgical procedures\textsuperscript{(12)}. These are relatively new techniques and have a long learning curve. In the current study, analysis of outcome was based on the VAS to assess the pain and the ODI to assess the functional disability preoperatively and post operatively, for both of them the scores were statistically significant ($p<0.001$) by a paired student $t$-test, which show reduction in pain and improvement in functional capacity postoperatively.

**Conclusion**

Degenerative spinal stenosis can be decompressed adequately with this approach without violating the integrity of the posterior elements, the reported technique yielded promising results in an elderly patients population with degenerative LSS, this technique is adequate and safe, can be well performed by surgeon with adequate experience in the field of lumbar spine surgery and future researches using different study designs and comparing the unilateral undercut decompression with other traditional surgical treatments at long-term follow-up is required.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors declare that they have no conflict of interest.

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**References**


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Early Detection of Non-Cavitated Occlusal Carious Lesion on the First Permanent Molar Using Laser Fluorescence and Impedance Spectroscopy (an in vivo study)

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Abstract

Dental caries is one of the most significant problems worldwide. Occlusal caries constitutes more than 90% of caries in children. Molars and premolars are considered as the most vulnerable teeth of carious attacks which is related to the morphology of their occlusal surfaces along with the difficulty of plaque removal. The aim of this study was to evaluate the clinical performance of an impedance spectroscopy technology (CarieScan pro device) and laser fluorescent (DIAGNOdent pen) for detecting non-cavitated occlusal carious lesions in the first permanent molar teeth.

A total of 139 first permanent molar teeth pooled from 50 children with age range of 8-9 years were examined. The selection criteria were teeth (first permanent molars) with carious lesions ranging from 0 to 3 according to ICDASII (gold standard) criteria then the clinical sensitivity, specificity and area under the receiver–operator curves of DIAGNOdent and CarieScan pro were examined. Repeatability was also analyzed using intra-class correlation coefficient (ICC).

Keywords: Dental caries, occlusal surface, enamel, ICDASII, CarieScan pro, DIAGNOdent pen, sensitivity, specificity, accuracy, AUC.

Introduction

Dental caries is an infectious disease process that is preventable and reversible at early stages1,2. People are susceptible for dental caries throughout their lifetime2. In spite of the benefits of its prevention through fluorides, toothpastes, sealants, improvements in diet, oral health education and dental care3, dental caries remains a major problem worldwide4 affecting 60–90% of schoolchildren and the vast majority of adults5,6.

The prevalence of dental caries is approximately 80% worldwide7. Molars and premolars are the most susceptible teeth for attacks of caries which is related to the morphology of their occlusal surfaces8 and the difficulty of plaque removal9. Many dentists, till now, treat the teeth by restoration when caries is still at enamel level10.

The conventional caries detection methods, such as visual inspection and radiographic examination, have been commonly used in clinical practice but they are able to detect carious lesions only at an advanced stage which mostly require restoration11. Visual examination of dental caries has progressed by establishing the international caries detection and assessment system (ICDAS)12; ICDAS-II was improved and developed to provide a standardized system13 that enables clinicians to diagnose and detect the first visual changes in enamel leading to better information for clinical management14,15. However, even when these well-described criteria are used, ICDAS is still examiner-dependent; therefore, the need for objective and quantitative tools is mandatory16,17.

Another relatively new device is CarieScan PRO which uses alternating current impedancespectroscopy (ACIS) to evaluate mineral density of the tooth24,25. This device is based on the fact that intact enamel works as a good insulator to the electrical current owing to its chemical composition18-20. This phenomenon changes
when the hard tooth structure is destroyed by caries, enabling the extent of demineralization of the enamel or dentine to be determined and quantified by means of ACIST.

The aim of the present clinical study was to evaluate the clinical sensitivity and specificity rates of DIAGNOdent and CarieScan pro as opposed to ICDAS II for the detection of initial occlusal caries in non-cavitated first permanent molars.

**Materials and Method**

This in vivo study involved 139 first permanent molars teeth pooled from 50 children aged (8-9) years attending the pediatric and preventive department in the College of dentistry / Baghdad University, Iraq.

The examination was performed after an informed consent was obtained from the parents or guardians of all subjects.

**Inclusion and exclusion criteria**

Teeth included in current study were varying from sound to different degrees of non-cavitated caries lesions which range from 0 to 3 in the visual assessment using a six-grade index of International Caries Detection and Assessment System (ICDAS). However, teeth with obvious cavitations on the occlusal surface, teeth with fillings, partial or complete fissure sealants, developmental defect like hypoplasia, fissure stain, orthodontic bands all of these were excluded from the study.

**Clinical examination**

All occlusal surfaces were cleaned with pumice slurry and extensively washed with water for 10 seconds [27] then the ICDAS II criteria were recorded first (Table 1) (used as gold standard method) followed by DIAGNOdent and CarieScan pro.

International caries detection and assessment system (ICDAS)

<table>
<thead>
<tr>
<th>Code</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Sound (no evidence of caries or change in enamel translucency after prolonged air drying for 5 seconds).</td>
</tr>
<tr>
<td>1</td>
<td>First visual changes in enamel seen only after air-dry the tooth for 5 seconds (opacity or discoloration is visible at the entrance to the pit or fissure).</td>
</tr>
<tr>
<td>2</td>
<td>Distinct visual changes in enamel seen when tooth is wet.</td>
</tr>
<tr>
<td>3</td>
<td>Localized enamel breakdown (without clinical visual signs of dentinal involvement) which can be confirmed by the use of WHO explorer.</td>
</tr>
</tbody>
</table>

**Laser pen (DIAGNOdent) (Kavo, Germany)**

DIAGNOdent was calibrated against ceramic standard using a fiber-optic tip which had been specifically designed by the manufacturer for the occlusal caries detection.

Teeth were assessed under cotton roll isolation and after brief air-drying with a 3-in-1 syringe for three seconds. The laser tip was recalibrated on a sound enamel region of anterior tooth to provide a baseline measurement (zero value).

**CarieScan pro (Dundee/Scotland, United Kingdom)**

Each tooth was air dried using a 3-in-1 syringe for 5 seconds. The CarieScan PRO sensor was placed on the tooth site to be measured (according to manufacturer’s instructions). Lesion extent and depth was determined using the CarieScan pro cut-offs recommended by manufacturer.

**Results**

One hundred thirty nine teeth were examined and
distributed to groups according to ICDAS II criteria for non-cavitated lesion as shown in Table 2 which was used as a validation for the DIAGNOdent and CarieScan pro results.

Table 2. Distribution of teeth according to ICDAS II scores

<table>
<thead>
<tr>
<th>Technique</th>
<th>No. of teeth</th>
<th>ICDAS II scores</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>ICDAS II</td>
<td>53</td>
<td>37</td>
<td>22</td>
</tr>
<tr>
<td>DIAGNOdent</td>
<td>72</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>CarieScan pro</td>
<td>24</td>
<td>62</td>
<td>34</td>
</tr>
</tbody>
</table>

The results of the sensitivity, specificity and accuracy of each technique were shown in Table 3 at enamel caries (D₁) and dentinal caries (D₃).

For the DIAGNOdent, the sensitivity at the D₁ was moderate (70%), but the specificity was significant (90%). At the D₃ threshold, the sensitivity was good (85%) with excellent specificity (94%) so the DIAGNOdent is good method for dentinal caries detection.

For the CarieScan pro, the sensitivity was excellent at the D₁ (90%) which indicated that it detects the earliest changes in tooth structure, but the specificity was better for D₃ threshold. For that reason, CarieScan pro can be useful for monitoring and prevention before the caries reaches the dentine.

Table 3 Sensitivity, specificity and accuracy of the studied methods

<table>
<thead>
<tr>
<th>Diagnostic technique</th>
<th>Cut-off point</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIAGNOdent</td>
<td>D₁*</td>
<td>70%</td>
<td>90%</td>
<td>0.773</td>
</tr>
<tr>
<td></td>
<td>D₃**</td>
<td>85%</td>
<td>94%</td>
<td>0.934</td>
</tr>
<tr>
<td>CarieScan pro</td>
<td>D₁</td>
<td>90%</td>
<td>46%</td>
<td>0.838</td>
</tr>
<tr>
<td></td>
<td>D₃</td>
<td>68%</td>
<td>90%</td>
<td>0.840</td>
</tr>
</tbody>
</table>

*: Enamel caries. **: Dentinal caries.

ROC curve analysis for each technique at occlusal enamel caries (D₁)

For the DIAGNOdent, the AUC was (0.773) which indicated that it’s fair technique for detection of enamel caries as in Figure(1).

Figure 1. ROC curve plot of the DIAGNOdent at the enamel threshold (D₁).
For CarieScan pro, the AUC was (0.838) which indicated that it’s a good technique for detecting enamel caries as in Figure (2).

![Figure 2. ROC curve plot of the CarieScan pro at the enamel threshold (D1).](image)

ROC curve analysis for each technique at occlusal dentinal caries (D3)

For the dentinal caries, the DIAGNOdent AUC was (0.934) which indicated that it’s excellent technique for detecting caries as shown in Figure (3).

![Figure 3. ROC curve plot of the DIAGNOdent at the dentinal threshold (D3).](image)

For CarieScan pro at the dentinal caries thresholds, the AUC was (0.840) which indicated that it’s a good technique for detecting caries as shown in Figure (4).

![Figure 4. ROC curve plot of the CarieScan pro at the dentinal threshold (D3).](image)

The reproducibility of each method

To assess the reproducibility of any diagnostic test, the cases were examined by two dentists and assessed by intra-class correlation coefficient (ICC). The results of the DIAGNOdent indicated that it’s a highly reproducible method with ICC = 0.911, while CarieScan pro method was with ICC = 0.720 which indicated its moderate reproducibility as shown in Table (4).

Table 4. ICC values for DIAGNOdent and CarieScan pro techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Intra-class Correlation Coefficient (ICC)</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>DIAGNOdent</td>
<td>.9110</td>
<td>.7510</td>
</tr>
<tr>
<td>Cariescan pro</td>
<td>.7200</td>
<td>.3440</td>
</tr>
</tbody>
</table>

Discussion

Visual inspection until now is the most widely used method in dental clinics for the detection of carious lesions [29,30], but it is subjective [31] and can be influenced by examiner’s experience with the diagnostic criteria [32]. Visual examination for detection of caries on occlusal surfaces seems to have low sensitivity and high specificity [33]; therefore, a lot of efforts have been made to improve its sensitivity.

In the present study the results of ROC curve analysis showed that the accuracy of DIAGNOdent (D1 = 0.773, D3 = 0.934) which indicated that it is a fair method for enamel caries detection and excellent for dentinal caries. In addition, its sensitivity at the enamel threshold was 70% while the specificity was 90% (excellent) at enamel threshold indicating that it recognizes the sound teeth with minimum false positive results. Also, its dentinal threshold sensitivity and specificity were 85%; 94%, respectively.

These results seemed to be important mainly when looking at the specificity which is the percentage of disease free individuals who are diagnosed correctly [34] which minimizes the false positive results and avoids
unnecessary intervention. High sensitivity and specificity for dentinal caries (at D$_3$ threshold) with good specificity at D$_1$ threshold indicated that DIAGNOdent is a good and accurate method mainly for detection of dentinal caries and performed better at D$_3$ threshold. These findings were in accordance with previous literature.[35]

The reproducibility of DIAGNOdent was assessed by ICC which was 0.911 in the present study, which indicated excellent reproducibility of the results.

A possible explanation of this disagreement is that the problems encountered on the tip of the device sensor. The sensor tip easily bends after each application and this affects both the angulations and the pressure applied on tooth surface. From a clinical standpoint, care should be given not to push the sensor on tooth forcefully for the consistency of the readings.

Conclusion

The highest sensitivity at the enamel caries (D$_1$) was with the CarieScan pro while the DIAGNOdent had the highest specificity at dentinal caries (D$_3$). The ICC for the DIAGNOdent was higher than that for the CarieScan pro.

DIAGNOdent is better in terms of specificity but the sensitivity of the CarieScan pro at the enamel threshold was better than that of the DIAGNOdent, so that, it is possible to observe the teeth and undertake a remineralizing intervention in the logic of “monitoring.”

Ethical Clearance: It was obtained from the Scientific Research Committee at College of Dentistry/University of Baghdad, Iraq.

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

References


Study the Types of Fat in People with Diabetes Type II

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Abstract

A total of 70 samples were collected for male and female infected persons to study the types of fat in people with type 2 diabetes and 30 samples of healthy men and women in order to know the ratios of chemical variables and their effect on type 2 diabetes. Triglyceride, good cholesterol, bad cholesterol, and lipoproteins are very low density for people with a high blood sugar level. Fat types of healthy people were also measured to determine the percentage of chemical variables and their effect on the person in general. A comparison was made between infected males and infected females as a model to determine the effect of diabetes on them. A comparison was made between healthy males and healthy females as a model to determine the effect of sugar on them. In addition, explanatory charts were shown the effect of fat on people with diabetes, in addition to That There are explanatory diagrams showing the effect of fat on healthy people

Keywords: fat, diabetes, DIABETES TYPE II, and cholesterol

Introduction

1-Fat and its types: Glycerol fat and three fatty acid molecules are linked to each other by a stearic bond. The chemical composition of fat includes carbon, hydrogen and oxygen, the same constituents of carbohydrates, but hydrogen is higher in fat than in carbohydrates. It provides the body with essential fatty acids that the body cannot make and is important for the growth of children and mental development and provides the body with lipid-soluble vitamins (A, D, E, K).

And a source of phosphorus through phospholipids. There are seven types of body fat that can be detected by laboratory tests that your doctor may ask to follow up on your health condition and is a good indicator of possible complications of diabetes related to the heart and arteries. Such as (Cholesterol, High-density lipids, low fat density, monounsaturated and non-saturated, polyunsaturated fats, Saturated fats, triglycerides).

2-Diabetes and its types: Diabetes is defined as an imbalance in the metabolism of sugar, which causes abnormally high levels of glucose (glucose) in the blood for various reasons that may be psychological, organic, excessive sugars, or genetic factors. It occurs as a result of an imbalance in insulin secretion of the pancreas. The amount of insulin that its secretion may be less than required or there is a complete cessation of its production. This condition is called insulin insufficiency, or in some cases the amount of fat is large, such as obese person but there is resistance from tissues and cells in the body impede the function of insulin. This condition is called “insulin resistance” In some cases, glucose is unable to enter cells, leading to accumulate the fats in the blood and the possibility of appearing in the urine. Over time, the accumulation sugar of may lead to chronic complications on some parts of the body, such as blood vessels in the retina of the eye, and kidneys, and those that feed nerves, including the first type

This type is also called “Guvenile Diabetes”. This type mostly affects children and adults under the age of thirty years and the peak of the onset of the disease between “11 and 13 years” But it may start in any age group, including aging. This type of diabetes occurs when the pancreas produces a small amount of insulin and since the body contains antibodies another Type which is called diabetes # 2 and an old one called insulin-dependent sugar (NIDDM). It was also called adult sugar because it usually starts after age forty. It is a chronic disorder that affects the ability of the body to
metabolize (glucose) glucose, which is the main source of energy for the body (9). And his type is found in some pregnant women and often in the second or third stage of pregnancy and this type affects pregnant women by (2-5%). It occurs when the hormone that is secreted through the placenta with the effect of insulin in the body and it disappears once the child is born. However, most women who are exposed to gestational diabetes develop type 2 diabetes after that, especially those who suffer from obesity (10).

**Materials and Method**

**Determination of Lipids & Lipoprotein in Blood Serum**

**Estimation of cholesterol concentration in serum**

**Basic Principle:**

Determine serum cholesterol level using the enzymatic method

Using the diagnostic kit manufactured by the Italian company (AMS) and depends on the conversion of cholesterol to quinoneimine dye with three enzymes Cholesterol esterase Cholesterol oxidase Peroxidase.

According to the following equations:

CE

Cholesteryl esters

Cholesterol + Fatty acids

CO

Cholesterol + O2 → Cholestenone + H2O2

H2O2

4-AA + Phenol → Quinoneimine + 4 H2

POD

If that

CE = Cholestrol Esterase, CO=Cholesterol Oxidase, POD=Peroxidase

**Reagents**

The loading kit consists of three containers containing the first solution, the second containing an enzyme and the third containing the standard solution.

Prepare the work solution by mixing the contents of the second bottle containing the enzyme with the contents of the first bottle containing a well-structured solution, and store the portable work in the first bottle and continue to prove this solution A period of four months when storing at a temperature of 2-8°C or one month when stored at a temperature 25-20°C

**Procedure**

Three test tubes (model, standard solution, blank) were used if each contained the solutions installed below(Table 1)

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Blank</th>
<th>Standard</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Reagent</td>
<td>1 ml</td>
<td>1 μl</td>
<td>1 μl</td>
</tr>
<tr>
<td>Distilled water</td>
<td>10 μl</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Standard</td>
<td>-</td>
<td>10 μl</td>
<td>-</td>
</tr>
<tr>
<td>Specimen</td>
<td>-</td>
<td>-</td>
<td>10 μl</td>
</tr>
</tbody>
</table>

Mix well and incubate at 37°C for 5 min. Optical absorption was measured using optical spectroscopy at a wavelength of 500 nm compared to the Blank solution.

**Calculations**

Determine the concentration of cholesterol according to the following equation: \((\text{Sample } \times \text{Abc})\)
Standard Conc × Conc.of Cholesterol(mg/dl) = ---------------------------
(Standard)Abc

Determination of Triglycerides concentration in serum

Basic Principle

The concentration of triglycerides in the serum was determined by using the enzymatic method using the diagnostic kit manufactured by the Italian company AMS. The principle of the reagent shows the following equations:

\[
\text{LPL} \quad \text{Triglycerides} + 3\text{H}_2\text{O} \quad \rightarrow \quad \text{Glycerol} + 3\text{FFA}
\]

\[
\text{GK} \quad \text{Glycerol} + \text{ATP} \quad \rightarrow \quad \text{Glycerol} - 3\text{-p} + \text{ADP}
\]

\[
\text{Glycerol} - 3\text{-p} + \text{O}_2 \quad \rightarrow \quad \text{DHAP} + \text{H}_2\text{O}_2
\]

\[
\text{H}_2\text{O}_2 \quad + \quad \text{Quinoneimine} \quad \rightarrow \quad \text{TOOS} + \text{H}_2\text{O}_2 + 4\text{-AA Phenol}
\]

POD

LPL = Lipase, GK Glycerol = kinase, POD = Peroxidase

GPO = Glycerol phosphor oxides

Reagents:

The kit consists of two parts, one of which is the work detector and the other the standard solution.

Procedure:

Three test tubes (model, standard solution, and blank) were used if each contained the solutions installed below (Table 2).

**Table 2. Testing tubes contents**

<table>
<thead>
<tr>
<th>Solutions</th>
<th>BLANK</th>
<th>SAMPLE</th>
<th>STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reagent A</td>
<td>1000μl</td>
<td>1000μl</td>
<td>1000μl</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>10μl</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Sample</td>
<td></td>
<td>10μl</td>
<td>-</td>
</tr>
<tr>
<td>Standard B</td>
<td></td>
<td></td>
<td>10μl</td>
</tr>
</tbody>
</table>

Mix and leave for 5 minutes at 37°C in the incubator or for 10 min at room temperature (15-25°C). Read model and standard absorption versus the Blanc solution using the optical spectrometer at a wavelength of 546 nm.

Calculations:

The concentration of triglycerides in serum was
calculated according to the following law:

\[
\text{(Sample)}A = \frac{\text{Standard Conc} \times \text{Conc.of Triglyceride (mg/dl)}}{\text{(Standard)}A}
\]

**Determination of High density lipoproteins (HDL-Ch.) in Blood Serum**

**Basic Principle**

The serum (HDL-Ch) level was estimated using a diagnostic kit manufactured by Spectrum of Egypt. And that the principle of the method depends on the enzymatic method in which the deposition of kylomycrone and lipoproteins of LDL-Ch and VLDL-Ch, by adding Phosphotungstic acid and the presence of magnesium ions. Only HDL-Ch remains in serum after centrifugation.

**Reagents:**

The prepared analysis kit consists of two containers containing the first Precipitant and the second the standard solution HDL-Cholesterol Standard as follows:

Need to provide a cholesterol detector

**Method**

The level of HDL-Cholesterol was measured by adding 0.5 ml of the solution to 0.2 mL of serum, mixing well and leaving at room temperature for 10 minutes. Place the mixture in the centrifuge for 10 minutes at 3000 rpm. And leave the deposit, after which I attended the following solutions (Table 3).

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Blank</th>
<th>Standard</th>
<th>Specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reagent Cholesterol</td>
<td>1ml</td>
<td>1ml</td>
<td>1ml</td>
</tr>
<tr>
<td>Distilled water</td>
<td>25 μl</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Standard</td>
<td>-</td>
<td>25 μl</td>
<td>-</td>
</tr>
<tr>
<td>Specimen Supematant</td>
<td>-</td>
<td>-</td>
<td>25 μl</td>
</tr>
</tbody>
</table>

Mix the solutions well and leave for 5 minutes at 0 °C or 10 °C at room temperature. Light absorption at a wavelength of 500 nm was then measured using the sample spectroscopy technique and the standard solution versus the blank solution within 60 minutes.

**Calculations:**

Determine the concentration of HDL-Ch. As follows:

\[
\text{(Sample)}Abs = \frac{\text{Standard Conc} \times \text{Conc.of HDL-Ch (mg/dl)}}{\text{(Standard)}Abs}
\]

**Determination of low Density lipoprotein–cholesterol (LDL Ch.) Concentration in serum**

**Basic Principle**

The concentration of lipoproteins and low density of cholesterol was calculated according to the metabolic relationship:

\[
LDL = \text{Total cholesterol} \times \frac{\text{Tri glyceride}}{5 \times \text{HDL}}
\]

**Determination of very Low density lipoproteins (VLDL-Ch) in Blood Serum**

\[
\text{Tri glyceride} \times \frac{\text{---}}{5} = \text{VLDL}
\]
Results and Discussion

It is known that humans become diabetic type II when accumulating a large amount of sugar in the blood as a result of the inability of the body to regulate the level of that sugar distributed by various organs of the body to burn in the form of energy kinetic or mental. The disease is directly attributable to the inability of the liver pancreas gland to secrete sufficient amount of insulin hormone, which regulates the level of sugar in the blood, has stabilized treatment for about a hundred years to compensate for the shortage of insulin in the body by injection subcutaneous doses, the following table has been compared For most infected men and women in diabetes as a mode .In these tables, the values obtained have been observed (Table 4). We note that the chemical variables have changed according to the situation. In the table of the infected males and females, the values were high often compared to the healthy table. This is evidence of the change of the chemical variables due to the health condition. It can be said that fat had a significant impact on the incidence of some people with diabetes, especially type 2 diabetes.

Table 4. Comparison biochemical parameters within study groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>sugar</td>
<td>Patients</td>
<td>70</td>
<td>47.21</td>
<td>8.89</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>30</td>
<td>25.43</td>
<td>4.26</td>
</tr>
<tr>
<td>cholestrole</td>
<td>Patients</td>
<td>70</td>
<td>7.36</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>30</td>
<td>3.36</td>
<td>0.86</td>
</tr>
<tr>
<td>TG</td>
<td>Patients</td>
<td>70</td>
<td>4.36</td>
<td>1.22</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>30</td>
<td>0.56</td>
<td>0.30</td>
</tr>
<tr>
<td>HDL</td>
<td>Patients</td>
<td>70</td>
<td>1.66</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>30</td>
<td>0.77</td>
<td>0.45</td>
</tr>
<tr>
<td>LDL</td>
<td>Patients</td>
<td>70</td>
<td>6.00</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>30</td>
<td>2.59</td>
<td>0.71</td>
</tr>
<tr>
<td>VLDL</td>
<td>Patients</td>
<td>70</td>
<td>0.87</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>30</td>
<td>0.11</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Result of current study shows the mean value was high for (sugar) parameters in patients than controls with high significant different (P<0.05) between study groups (Table 5).
Table 5. Correlation relationships between biochemical parameters among patients.

<table>
<thead>
<tr>
<th>NT=70</th>
<th>sugar</th>
<th>cholesterol</th>
<th>TG</th>
<th>HDL</th>
<th>LDL</th>
<th>VLDL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>.133</td>
<td>.042</td>
<td>.251*</td>
<td>.201</td>
<td>.042</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>.268</td>
<td>.730</td>
<td>.035</td>
<td>.093</td>
<td>.730</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>.133</td>
<td>1</td>
<td>.310**</td>
<td>.159</td>
<td>.231</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>.268</td>
<td>.009</td>
<td>.186</td>
<td>.053</td>
<td>.009</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>.042</td>
<td>.310**</td>
<td>1</td>
<td>.080</td>
<td>.210</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>.730</td>
<td>.009</td>
<td>.508</td>
<td>.079</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>.251*</td>
<td>.159</td>
<td>.080</td>
<td>1</td>
<td>.083</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>.035</td>
<td>.186</td>
<td>.508</td>
<td>.491</td>
<td>.508</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>.201</td>
<td>.231</td>
<td>.210</td>
<td>.083</td>
<td>1</td>
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<tr>
<td></td>
<td>p</td>
<td>.093</td>
<td>.053</td>
<td>.079</td>
<td>.491</td>
<td>.079</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>.042</td>
<td>.310**</td>
<td>1.000**</td>
<td>.080</td>
<td>.210</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>.730</td>
<td>.009</td>
<td>0.000</td>
<td>.508</td>
<td>.079</td>
</tr>
</tbody>
</table>

R=pearson correlation
P=probability.
NT=number total
*= high correlation
**=very high correlation.

Data of current study were analysed by using (t test) to compared between two parameters of quantitative data (Mean±SD). So, we used pearson correlation ( r ) to measure correlation relationships between parameters. A level of significance of α=0.05 was applied to test. (SPSS v.22) programs used to analyze current data.

Conclusions

High cholesterol, triglycerides, and very low density lipoproteins (VLDL)

In patients with diabetes. The high level of insulin linked in Type II patients compared to control and lower levels in type 1 patients For diabetes compared to control.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

References


Biochemical Study of the Association between Serum Level Zinc, Copper and Selenium with Hormone of Thyroid Gland in Patients with Thyroid Disorder

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¹University of Karbala, College of Dentistry, Iraq

Abstract

This study was conducted in AL-Hussein General Hospital, Imam Zine Alabiden Hospital, and out patients clinic in Karbala city, to determine the value of thyroid hormone (T₃ triiodothyronine, T₄ tetraiodothyronine and thyroid stimulating hormone and the concentration of the Zinc, Copper and Selenium in patients with thyroid disorder (hyperthyroidism 31) and hypothyroidism 26, and evaluate the association between them. All patients were females range in the age from (20 -55 years), and control group were 50 healthy group. The were collected from the medical staff and patients relatives who were free from signs and symptoms of thyroid disorder all of these group are female.

The results of the study showed that the concentration of serum zinc and copper in patients with hyperthyroidism was higher than control (p <0.001 ). The concentration of serum selenium in patient with hyperthyroidism was lower than control (p <0.001 ). The concentration of serum zinc, copper and selenium in patients with hyperthyroidism was lower than control (p <0.001). The concentration of serum zinc in patients with hyperthyroidism was lower than control (p <0.001).

Keywords: T₃ triiodothyronine, T₄ tetraiodothyronine, hyperthyroidism.

Introduction

Thyroid gland located immediately below the larynx on each side of and anterior is one of the largest endocrine gland, normally weighting 15-20 grams in adults and increased in pregnancy¹,². The thyroid gland is essential to normal body growth in infancy and childhood. It is also regulate the metabolic rate³. It secreted the hormones thyroxin directly into the blood by absorbing iodine from the diet because the iodine an essential component of the hormone⁴.

The primary function of thyroid gland is production of thyroxin (3,5,3,5 tetraiodothyroinine) T₄ and (3,5,3 triiodothyronine) T₃ and calcitonin a hormone concerned with calcium homeostasis⁵.

Thyrotropin of (thyroid–stimulating hormones) (TSH) is a glycoprotein hormone released by the anterior pituitary gland that stimulates the thyroid gland to release thyroxine and T₃⁶. The release of thyrotropin is triggered by the action of thyrotropin-releasing facter (TRF). A substance found in the hypothalamus of the brain⁷. Thyroxin inhibits the further release of thyrotropin with the action of TRF, thus the levels of thyroid hormones are regulated. If not enough iodine is available in the diet, then not enough thyroxin will be made to shut off the release of thyrotropin⁸. The synthesis of thyroid hormones is controlled by feedback regulation. T₃ appears to be more actively involved than T₄ in the regulation process. The production of (TSH) by pituitary and ( TRH ) by hypothalamus are inhibited by T₃ and, to a lesser degree by T₄ .The increased production of TSH and TRH occurs in response to decreased circulatory levels of T₃ and T₄ , the body has sufficient stores of hormones to last for several weeks. Hence it takes some months observe thyroid functional deficiency⁹,¹⁰.

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E-mail: hasanin.jawad@yahoo.com
Hyperthyroidism is a condition in which there is overproduction of thyroid hormone by the thyroid gland, causing the levels of thyroid hormone in the blood to be too high. People who have it are often said to have an (overactive thyroid).11,12

**Materials and Method**

**Patients and control group**

Two groups of thyroid dysfunction patients (all female) were included in this study, in addition to a healthy group. All samples were collected from a laboratory unit in Al-Hussein General Hospital and Imam Zain Al-Abiden Hospital in Karbala and an outpatients clinic. The patients were classified into three groups.

Group (I) consisted of 31 patients with hyperthyroidism (mean age 41.9 ± 9.7 yr). Group (II) consisted of 26 patients with hypothyroidism (mean age 41.8 ± 11 yr). Control group (III) consisted of 40 persons (females and hypothyroidism) (mean age 40.68 ± 11.1 yr).

Specimen collection: The samples were collected from patients who were admitted for treatment in Al-Hussein General Hospital and Imam Zain Al-Abiden Hospital in Karbala and an outpatients clinic. Five milliliters of venous blood were drawn from patients and control. Slow aspiration of the venous blood sample via the needle of syringe to prevent the hemolysis with tourniquet applied in the anterior. All the samples that were grossly hemolysis samples were neglected and other new samples were taken. The samples were dropped into clean disposables tubes, left at room temperature for 30 min. for clotting formation and then centrifuged for 20 min. at 5000 rpm.

Each serum sample was analyzed for T3, T4, TSH, Zn, Cu, and Se. All assays were obtained by running duplicates for test, control, and standard (13-18).

**Determination of Zinc in the serum**

Serum sample were prepared by dilution with deionized distilled water in a dilution 1/100 (50 μL of serum in 5 mL of deionized distilled water). The determine the concentration of Zinc equation of the strain line of standard curve of the Zinc.

**Determination of Copper in the serum**

Serum sample were prepared by dilution with a dilution of 1/10 (300 μL of serum in 3 mL of 0.1 N HNO3). Then determine the concentration of copper in the equation of the striate line of standard curve of the copper.

**Statistical Analysis**

All results were presented as mean ± standard deviation (M ± SD). Statistical analysis were performed using SAS taking (p<0.05) as lowest limit significances.

**Results**

A total of (97) patients were studied, all of these patients were female and with age ranging between 22-55 years. A mean age of patients with hypothyroidism (41 ± 11.1) years as table (1), the mean age of patients with hyperthyroidism (47 ± 9.7) and the mean age of control group (40.68 ± 11.1) as shown in table (1), the serum samples were used in this study.

**Table 1. The correlation Coefficients between T3, T4, TSH, Zn, Cu and Se**

<table>
<thead>
<tr>
<th></th>
<th>T3</th>
<th>T4</th>
<th>TSH</th>
<th>Zn</th>
<th>Cu</th>
<th>Se</th>
</tr>
</thead>
<tbody>
<tr>
<td>T3</td>
<td>r 1.0000</td>
<td>r 0.9189</td>
<td>r -0.7717</td>
<td>r 0.7185</td>
<td>r 0.6547</td>
<td>r -0.2435</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0265</td>
</tr>
<tr>
<td>T4</td>
<td>r 0.9189</td>
<td>r 1.0000</td>
<td>r 0.7531</td>
<td>r 0.7531</td>
<td>r 0.6547</td>
<td>r -0.3473</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0008</td>
</tr>
<tr>
<td>TSH</td>
<td>r 0.8020</td>
<td>r -0.7717</td>
<td>r 1.0000</td>
<td>r -0.6547</td>
<td>r 0.7754</td>
<td>r 0.0008</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>1.0000</td>
<td>0.9942</td>
</tr>
<tr>
<td>Zn</td>
<td>r 0.7185</td>
<td>r 0.7531</td>
<td>r -0.6547</td>
<td>r 1.0000</td>
<td>r 0.6547</td>
<td>r 0.0008</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>1.0000</td>
<td>p&lt;0.0001</td>
<td>0.9942</td>
</tr>
<tr>
<td>Cu</td>
<td>r 0.8089</td>
<td>r 0.8624</td>
<td>r -0.7124</td>
<td>r 0.7754</td>
<td>r 0.7754</td>
<td>r 0.0008</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>p&lt;0.0001</td>
<td>1.0000</td>
<td>p&lt;0.0001</td>
<td>0.9942</td>
</tr>
<tr>
<td>Se</td>
<td>r -0.2435</td>
<td>r -0.3473</td>
<td>r 0.7124</td>
<td>r 0.7754</td>
<td>r 0.6547</td>
<td>r 0.0008</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.0265</td>
<td>0.0013</td>
<td>p&lt;0.0001</td>
<td>1.0000</td>
<td>p&lt;0.0001</td>
<td>0.9942</td>
</tr>
<tr>
<td></td>
<td>r 0.0008</td>
<td>r 0.0012</td>
<td>r 0.0008</td>
<td>r 0.0001</td>
<td>r 0.0005</td>
<td>r 1.0000</td>
</tr>
</tbody>
</table>
Comparison between hyperthyroidism and control groups

The comparisons between the concentration of Copper, Zinc and Selenium in patients with hyperthyroidism are summarized in table (2), Zn and Cu increase in patients with hyperthyroidism but the concentration of selenium decrease in patients with hyperthyroidism.

Table 2. Comparison between patients with hyperthyroidism and control groups.

<table>
<thead>
<tr>
<th></th>
<th>Hyperthyroidism</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>41</td>
<td>40</td>
</tr>
<tr>
<td>Mean of age (year)</td>
<td>41.68 ± 11.1</td>
<td>40.68 ± 11.1</td>
</tr>
<tr>
<td>Total T3 (ng/mL)</td>
<td>3.78 ± 0.9</td>
<td>1.11 ± 0.317</td>
</tr>
<tr>
<td>Total T4 (μg/dL)</td>
<td>23 ± 3.94</td>
<td>7.94 ± 2.14</td>
</tr>
<tr>
<td>TSH (μIU/mL)</td>
<td>0.0198 ± 0.15</td>
<td>4.48 ± 1.79</td>
</tr>
<tr>
<td>Zn (μg/dL)</td>
<td>92.02 ± 8.2</td>
<td>86.2 ± 9.9</td>
</tr>
<tr>
<td>Cu (μg/dL)</td>
<td>179.3 ± 9.1</td>
<td>118.1 ± 25</td>
</tr>
<tr>
<td>Se (μg/dL)</td>
<td>0.34 ± 0.3</td>
<td>0.89 ± 0.4</td>
</tr>
</tbody>
</table>

Comparisons between hypothyroidism and control group-

The comparison between the concentration of copper, Zinc and selenium in patients with hypothyroidism are summarized in table (3), Zn, Cu and Selenium were lower in patients with hypothyroidism.

Table 3. Comparison between patients with hypothyroidism and control groups.

<table>
<thead>
<tr>
<th></th>
<th>Hyperthyroidism</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>26</td>
<td>40</td>
</tr>
<tr>
<td>Mean of age (year)</td>
<td>41 ± 11.1</td>
<td>40.68 ± 11.1</td>
</tr>
<tr>
<td>Total T3 (ng/mL)</td>
<td>0.35 ± 0.105</td>
<td>1.11 ± 0.317</td>
</tr>
<tr>
<td>Total T4 (μg/dL)</td>
<td>3.4 ± 0.48</td>
<td>7.94 ± 2.14</td>
</tr>
<tr>
<td>TSH (μIU/mL)</td>
<td>14.5 ± 1.84</td>
<td>4.48 ± 1.79</td>
</tr>
<tr>
<td>Zn (μg/dL)</td>
<td>54.4 ± 12</td>
<td>86.2 ± 9.9</td>
</tr>
<tr>
<td>Cu (μg/dL)</td>
<td>82 ± 16.5</td>
<td>118.1 ± 25</td>
</tr>
<tr>
<td>Se (μg/dL)</td>
<td>0.53 ± 0.28</td>
<td>0.89 ± 0.33</td>
</tr>
</tbody>
</table>

Comparisons between hypothyroidism and hyperthyroidism

The comparison between the patients with hyperthyroidism and the patients with hypothyroidism are summarized in table (4), serum Zn, Cu increase in hyperthyroidism, Se was lower in patients with hypothyroidism and in the hypothyroidism
Table 4. Comparison between patients with hypothyroidism and control groups.

<table>
<thead>
<tr>
<th></th>
<th>Number of patients</th>
<th>Hyperthyroidism</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n )</td>
<td>31</td>
<td>26</td>
</tr>
<tr>
<td>Mean of age</td>
<td>(year )</td>
<td>41.97±13.8</td>
<td>40.68 ± 11.1</td>
</tr>
<tr>
<td>Total T3</td>
<td>(ng/mL)</td>
<td>3.78± 0.9</td>
<td>035 ± 0.105</td>
</tr>
<tr>
<td>Total T4</td>
<td>(μg/ dL )</td>
<td>23± 3.94</td>
<td>3.5 ± 0.4 8</td>
</tr>
<tr>
<td>TSH</td>
<td>(μIU/mL )</td>
<td>0.198± 0.15</td>
<td>14.5 ± 1.79</td>
</tr>
<tr>
<td>Zn</td>
<td>(μg/dL )</td>
<td>92.02±8.2</td>
<td>54.4 ± 12</td>
</tr>
<tr>
<td>Cu</td>
<td>(μg/dL )</td>
<td>± 9.1 179</td>
<td>82± 16.5</td>
</tr>
<tr>
<td>Se</td>
<td>(μg/dL )</td>
<td>0.34±0.33</td>
<td>0.53± 0.28</td>
</tr>
</tbody>
</table>

Determination of Copper ion in patients with thyroid disease by using spectrophotometric method

In this part of this study is measured the concentration of Copper ion to three patients with hyperthyroidism and three patients with hypothyroidism and compared the result of this technique with the result of atomic absorption technique. The value of concentration of copper ion in patients with hyperthyroidism and hypothyroidism in this technique summarized in table (5) and table (6) respectively.

Table 5. The value copper in patient with hyperthyroidism

<table>
<thead>
<tr>
<th>Sample number</th>
<th>T3</th>
<th>T4</th>
<th>TSH</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.1</td>
<td>26</td>
<td>0.09</td>
<td>191</td>
</tr>
<tr>
<td>2</td>
<td>5.2</td>
<td>29</td>
<td>0.05</td>
<td>184</td>
</tr>
<tr>
<td>3</td>
<td>4.4</td>
<td>26.6</td>
<td>0.08</td>
<td>193</td>
</tr>
</tbody>
</table>

Table 6. The value of copper in patient with hypothyroidism

<table>
<thead>
<tr>
<th>Sample number</th>
<th>T3</th>
<th>T4</th>
<th>TSH</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.19</td>
<td>2.1</td>
<td>16.3</td>
<td>102</td>
</tr>
<tr>
<td>2</td>
<td>0.22</td>
<td>2.0</td>
<td>18</td>
<td>87</td>
</tr>
<tr>
<td>3</td>
<td>0.36</td>
<td>2.7</td>
<td>13.2</td>
<td>81</td>
</tr>
</tbody>
</table>

Compression of serum copper concentration between the atomic absorption and spectrophotometric method in patients with hyperthyroidism and hypothyroidism:

The comparison between atomic absorption and spectrophotometric method was summarized in table (7). In general, The concentration of Cu in atomic absorption is lower than spectrophotometric method.

Conclusions

1-The concentration of serum copper in patients with hyperthyroidism is higher than the control group (p<0.001).

2-The concentration of serum Zinc in patients with hyperthyroidism is higher than the control group (p<0.001).

3-The concentration of serum selenium in patients with hyperthyroidism is lower than the control group (p<0.001).

4-The concentration of serum copper in patients with hypothyroidism is lower than the control group.
5- The concentration of serum Zinc in patients with hypothyroidism is lower than the control group \( p<0.001 \).

6- The concentration of serum selenium in patients with hypothyroidism is lower than the control group \( p<0.001 \).

7- Determination of this trace element by atomic absorption was more precession and economic than spectrophptometric method.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding.

**References**


9- C. S. Hollander, Clinical laboratory observation in cases confirmed by radio of T3 Toxicosis confirmed by radioimmunoassay, 2000, vol4, pp 11-20.


Effect of Radiation Therapy on the Health of Cancer Patients

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College of Applied Medical Science, kerbala University, Iraq

Abstract

This study investigates the effect of radiation therapy on the general health of cancer patients. This study was carried out through the knowledge and follow-up of the health status of a group of cancer patients to different hospitals in some governorates of Iraq. After monitoring the health of patients, it was found that most of them will suffer from hair loss, some suffer from vomiting and nausea, others suffer from diarrhea, some suffer from internal bowel damage as well as damage to the central nervous system as well as the effect of radiation in the damage of DNA of the cells of the human body. The ages studied are (10-20, 20-30, 30-40, 40-50, 50-60).

Keywords: Cancer, Radiation therapy, DNA damage.

Introduction

Radiation therapy (also known as x-ray therapy) is the treatment of cancer through the use of high-energy x-ray beams. These rays can penetrate tissue and in doing so, they deposit their energy into the cells in the treatment area and cause cell damage and cell death in the cancer growth. Cancer is a multigenic and multicellular disease that can arise from all cell types and organs with a multi-factorial etiology.

Normal cells are also affected by radiation. Unlike to cancer cells, most of them recover from the effects of radiation. Normal tissue, however still needs to be protected from radiation as far as possible, the total amount of radiation is thus limited to the dose that normal tissue can endure. The radiation therapy is also given over a varying period of time. Cancer stays leading cause of death globally. The International Agency for Research on Cancer (IARC) latterly estimated that 7.6 million deaths worldwide were due to cancer with 12.7 million new cases per year being reported worldwide. A significant ration of this burden is borne by developing countries, 63% of cancer deaths are reported to be from developing countries. Every patient’s treatment is planned individually with the use of computer technology. Normal tissue is protected from radiation beams, where possible, by the use of alloy shielding blocks or special collimation systems. The past decade has witnessed a considerable progress towards the treatment and understanding of the earlier suggested hallmarks of cancer, and together with advances in early detection and in the various treatment patterns, many cancers have become curable. Usually in radiotherapy we use the treatment plan decided at the beginning of therapy all the way through the treatment course. In adaptive radiotherapy, we use different scans and pictures taken part way through the treatment to make a new treatment plan. This means we can hit the tumour better if it moves or if the cancer shrinks we could make our beams smaller so we hit fewer normal cells. This technique makes us hit the cancer better and could potentially allow us to reduce the dose to the normal cells. If we reduce the dose to normal cells we could increase the dose to the cancer. Furthermore, approximately 50% of all cancer patients will receive radiation therapy during their course of illness with an estimation that radiation therapy contributes to around 40% towards curative treatment.

The aim of radiation therapy is to kill cancer cells with as little hazard as possible to normal cells. Radiotherapy can be used in the treatment of different types of cancer in nearly any part of the body. Radiation, like surgery, is a local treatment. It thus affects only the tissue in the specific area of the body that is being...
Radiation is often used in combination with surgery to treat cancer. Doctors can give radiation before surgery to shrink a cancer mass, thus enabling them to remove all cancer tissue without using extensive surgical methods. Radiotherapy can also be given after surgery to lessen the chances of regrowth of any remaining cancer cells. In some cases radiation is used in combination with chemotherapy. The radiation can be given before, during or after chemotherapy. Combination therapy is tailored carefully to suit each individual patient’s needs according to the type of cancer, the location thereof and the disease stage. Where cure isn’t a realistic option anymore, radiation is often used to shrink cancer masses and in doing so relieve pressure, pain and other symptoms associated with uncontrolled cancer growth. This treatment is known as palliation (symptom relief). Most cancer patients find that they can lead a better quality life after radiation for problematic symptoms.

Photons radiation (x-rays and gamma rays), which are to a large degree used Photon beams carry a low radiation charge and have a much lower mass. X-rays and gamma rays are sparsely ionizing radiations, considered low LET (linear energy transfer) electromagnetic rays and further composed of massless particles of energy are called photons. X-rays are generated by a device that excite electrons (e.g. cathode ray tubes and linear accelerators), while gamma rays originate from the decay of radioactive substances (example .cobalt-60, radium and cesium).

**Materials and Method**

In this research, data were taken from different hospitals in the most governorates of Iraq.

**Results**

Data:

The data included documentation of the effect of radiotherapy on the body of a group of patients and different ages. To know the difference between the effects of radiation therapy on human health and thus study these changes in the tissue and physiological and study the causes of the occurrence of the body, and can return to good health after the disappearance of cancer from the body and the recovery of the body (Table 1).

<table>
<thead>
<tr>
<th>Effect type</th>
<th>Age</th>
<th>10-20</th>
<th>20-30</th>
<th>30-40</th>
<th>40-50</th>
<th>50-60</th>
</tr>
</thead>
<tbody>
<tr>
<td>hair loss</td>
<td></td>
<td>20%</td>
<td>40%</td>
<td>80%</td>
<td>85%</td>
<td>70%</td>
</tr>
<tr>
<td>vomiting and nausea</td>
<td></td>
<td>90%</td>
<td>89%</td>
<td>76%</td>
<td>72%</td>
<td>87%</td>
</tr>
<tr>
<td>Diarrhea</td>
<td></td>
<td>60%</td>
<td>68%</td>
<td>73%</td>
<td>90%</td>
<td>94%</td>
</tr>
<tr>
<td>internal bowel damage</td>
<td></td>
<td>0</td>
<td>15%</td>
<td>40%</td>
<td>79%</td>
<td>88%</td>
</tr>
<tr>
<td>damage to the central nervous</td>
<td></td>
<td>0</td>
<td>5%</td>
<td>40%</td>
<td>23%</td>
<td>37%</td>
</tr>
<tr>
<td>Damage of DNA</td>
<td></td>
<td>30%</td>
<td>35%</td>
<td>67%</td>
<td>58%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Table 1. The effect of radiotherapy on the body of a group of patients and different ages.
There is a border to the amount of radiation an area of your body can safely extradite over the course of your lifetime. Depending on how much radiation an area has already been treated with, you may not be able to have radio-therapy to that area a second time. But, if one part of the body has already received the safe lifetime dose of radiation, another area may still be treated if the distance between the two areas is large enough.

**Discussion**

Radiation therapy not only destroys cancerous cells, but may also affect healthy cells in your body. The healthy cells that are most at risk for being damaged by radiation therapy are those that tend to grow at a fast rate, including hair cells. Thinning of hair and, in some cases, complete hair loss may result. Hair growth is the result of a dynamic balance between factors that promote and inhibit hair growth. Singh et al. have reviewed thermal and non-thermal genotoxic infections of cell phone radiation, modifying and altering activity of genes and chromosomes. Therefore, hair loss for patients with cancer varies when they use radiotherapy according to age, as shown above. Published observational trials on radio-therapy induced nausea and vomiting (RINV) highlight that the overall cumulative incidence of vomiting and nausea is about one third of patients undergoing radiotherapy. Radiotherapy (RT) induced nausea and vomiting might occur 1-2 hours after treatment. The incidence and severity depend on several factors. Treatment related factors are site and volume of radiation, single and total dose and fractionation schedule. Psychological Nausea and Vomiting is induced by anxiety. It is suggested by the signs and symptoms of stress, example anticipatory N&V that might occur due to previous experience with N&V during prior cancer therapy see figure (1).

Radiation-induced diarrhoea, may be an acute side effect of radiotherapy treatment to the pelvic area. While radiation induced diarrhoea is a well known complements of radiotherapy the patho-physiology of the effect that it has on the gastrointestinal tract is both poorly defined and understood. The percentage of infection caused by radiation treatment is increased as the age increases, the lower the injury, as shown in the chart above.

**Figure 2. Show the effect of radiotherapy on vomiting and nausea.**

Radiation-induced diarrhoea results from the disarrangement of immature stem cells secreting fluid into the lumen and the inhibition of mucosal absorption of the fluid by the villi, causing increased fluid and electrolytes in the lumen, which peaks 1-2 weeks post-irradiation see figure(3).

**Figure 3. Show the effect of radiotherapy on diarea.**

The bowel is made up of the small bowel and the large bowel. Sometimes, pelvic radiotherapy can cause changes to the way the bowel works. In some people these changes will not get better after treatment finishes. Others may not develop until months or years after treatment has finished. Pelvic radiotherapy can cause scarring (fibrosis) in the lining of the large bowel which can mean solid waste passes through quickly. The muscles that help to contract stool in the rectum may also be weakened. Sometimes, pelvic radiotherapy

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**Figure 1. Show the effect of radiotherapy on hair loss.**
causes the small blood vessels in the bowel to become more fragile and may cause the bowel to narrow. These changes lead to symptoms such as diarrhoea, constipation, leaking (incontinence), or bleeding from the back passage. In general, radiation related change in tissue is characterized by a reduction in the normal inflammatory cell population. Many bowel problems can be managed or treated successfully. Tell your doctor about any symptoms you are having. They can give you advice and may do some tests. They may also refer you to see a bowel specialist (a gastroenterologist) see figure(4).

Numerous preclinical studies reported that the effect of ionizing radiation on apoptosis is dose dependent and take place within hours after treatment. Radiation has been shown to induce apoptosis in the CNS (central nervous system), primarily in the neonatal or early postnatal brain but also in the brain of young adult rats. In this study, which was conducted on cancer patients was recorded the highest percentage of central nervous system damage by radiation therapy are in the ages ranging from 30-40 and followed by the ages ranging from 50 to 60 and then 40-50 and then after 20-30 and the latter have ages ranging from 10-20 see figure(5).

For some people, radiotherapy possibly the only treatment you need. But, oftentimes, you will have radiation therapy with other cancer treatments, like surgery, chemotherapy, and immunotherapy. Radiation therapy may be given before, during, or after these other treatments to develop the chances that treatment will work. The thoroughness of time that when radiation therapy is given depends on the type of cancer being treated and whether the goal of radiation therapy is to treat the cancer or ease symptoms.

**Conclusion**

The main purpose of this statistical study, which included the effect of radiation therapy on the human body in terms of histological and physiological and knowledge of the type of this effect on the body, and what is done by radiation treatment and changes in the body and for different ages, by documenting the proportion of the age of the patient and Type of effect on the body. There may be only one negative effect of the patient’s body due to radiation therapy, and there may be two types of changes or effects or more, so we put the field open to researchers through this study, In order to develop expertise and research in the scientific fields that have come to know a specific treatment for
cancer instead of radiation therapy and thus ensure that no changes in the tissue and physiological body of the patient suffering from cancer.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding

**References**


Role of Vitamin D3 in Breast Cancer Development among Iraqi Patients

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Abstract

Breast cancer (BCa) still a big problem for women and many factors play a crucial role in its development. The goal of this investigation to shed light on the role of Vitamin D3, as well as Leptin in Breast Cancer development.

One hundred females complaining from breast tumor has been enrolled in this study. Histopathological study showed that 75 of them had Breast Cancer and the remaining had benign tumors. Enzyme linked Immunosorbent Assay was applied for estimation of Leptin Vitamin D3 and Ca 15.3 levels in the sera of those women and the results were compared with those for 50 apparently healthy volunteers control group. This study revealed that most breast masses occur within left breast (70%) and majority of them were ductal (49.3%) type. Additionally, the risk age for BCa development was noticed among age 40-49 years with a frequency of 40%. Moreover, it was observed that there was significant difference in the mean of Vitamin D3 among BCa (17.46±10.94 ng/ml) in comparison with healthy controls (21.17±8.73 ng/ml) (<0.05). Mean of tumor marker Ca 15.3 concentration was elevated in highly significant manner among BCa sera (30.18±38.81 ng/ml) in comparison with disease control group (i.e. Benign tumor cases) (14.30±7.46 ng/ml) and healthy control group (14.64±6.73 ng/ml) (P < 0.001).

According to the above results it could be concluded that Vitamin D3 can be a good therapeutic agent to prevent development of BCa particularly among women after menopause age. Tumor marker Ca15.3 was reckoned as a best indicator for BCa.

Keywords: Vitamin D3, Breast cancer, Ca 15.3.

Introduction

One in eight women will develop breast cancer over their lifetime¹. For this reason breast cancer prevention’s efforts are essential. Vitamin D, with anticancer properties, may have a role in prevention of some cancers, including breast cancer (BCa). Vitamin D (the sunshine vitamin) plays a vital role in many aspects. The worldwide prevalence of vitamin D deficiency is approximately 1 billion. Vitamin D deficiency is a serious health problem with numerous health consequences; it is associated with many diseases². Several epidemiological studies have found that low vitamin D levels are associated with worse prognosis and poorer outcomes in patients with BCa, although some failed to find this association³.

A number of epidemiological studies show an inverse association between BCa risk and vitamin D status in humans⁴. Vitamin-D levels have inverse correlations with postmenopausal state, obesity, poor sun exposure and low intake of vitamin-D rich diet⁵. Many reports showed an inverse association between serum vitamin D concentration and incidence of several cancers, including BCa⁶.

Endocrine action of vitamin D and anticancer activities including BCa has been reported too⁷. The cellular effects of Vitamin D are mediated via Vitamin D receptor (VDR), which is a member of the nuclear receptor superfamily and a key mediator in the vitamin D pathway. VDR is expressed in the breast tissue, and its polymorphism may participate in BCa development⁷.
Since breast epithelial cells possess an enzymatic system enhance local generation of active vitamin D from circulating precursors, makes the effect of vitamin D in BCa biologically plausible.\(^6,8\)

Considering the rising incidence of BCa and high prevalence of vitamin D deficiency, this study aimed to reflect an association between serum vitamin D concentration and breast cancer risk.

**Materials & Method**

One hundred blood samples had been collected from patients suffering from abnormal breast masses during the period June/ 2017- Jan/ 2018 who admitted Oncology Hospital in Baghdad City. Seventy five samples were diagnosed as BCa while 25 represented disease control group (Benign tumors). Tumor marker Ca 15.3 (Calbiotech Lot. CAS5133) and Vitamin D3 (Euroimmun lot. E170908DO) were quantitated in the patients sera via ELISA techniques and the results were compared with those for 25 apparently healthy volunteers as healthy control group. Body Mass Index was estimated by sub division of Body Weight (Kg) on Length Square (m\(^2\)) for all the individuals of the above groups.

**Statistical Analysis**

All data was statistically analyzed using SPSS program version 18. To estimate P value by Chi-square and student t-Test\(^9\).

**Results**

**Demographical Picture for The Studied Groups**

The main demographical characteristic for the individuals within the studied groups was listed in Table 1. This table revealed that the mean of patients age was (48.06±10.91 years) which is higher than that for disease control group (44.74±10.11 years) (P=0.04).

**Table 1. Demographical picture for the studied groups**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Study Groups</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Breast cancer patients (BCa)</td>
<td></td>
</tr>
<tr>
<td>(No.=75)</td>
<td>(No. =25)</td>
<td>Control (HC) (No.=50)</td>
</tr>
<tr>
<td>Age (Mean ±SD)</td>
<td>48.06±10.91</td>
<td>48.4±8.7</td>
</tr>
<tr>
<td>BMI Kg/m(^2) (Mean ±SD)</td>
<td>29.08±5.70</td>
<td>28.86±4.10</td>
</tr>
<tr>
<td>Ca 15.3(Mean ±SD)</td>
<td>30.18±38.81</td>
<td>14.30±7.46</td>
</tr>
<tr>
<td>Vit. D3 (Mean ±SD)</td>
<td>17.46±10.94</td>
<td>19.45±9.76</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>25</td>
</tr>
</tbody>
</table>

Furthermore, BCa patients and benign breast masses patients showed highly significant differences in mean of BMI [(29.08±5.70Kg/m\(^2\)) and (28.86±4.10Kg/m\(^2\)) for BCa and Benign Tumors groups respectively] in comparison with healthy control group (27.77±3.23Kg/m\(^2\)) (P= 0.001). It was clear from this table that there was highly significant elevation in the mean of Ca 15.3 concentration among BCa patients (30.18±38.81 ng/ml) in comparison with benign breast tumor groups (14.30±7.46 ng/ml) and Healthy Control (HC) group (14.64±6.73). (P = 0.001). On the contrary, Vitamin D3 showed significant decrements in its level among BCa patients (17.46±10.94 ng/ml) in comparison with disease control group (19.45±9.76 ng/ml) and HC group (21.17±8.73 ng/ml) (P<0.05).

**Effect of Obesity on Breast Cancer Development**

Distribution of the studied groups’ members according to the BMI was listed in Table 2 which revealed that [36 out of 75 (24%)] BCa patients were over-weighed and [9 (6 %)] were obese while benign mass cases of over weighed were represented [13 out of...
25 (8.7%) Benign tumor patients and only [2(1.3%)] were obese. Meanwhile, HC showed [17out of 25 (11.3%)] were overweighed whereas only [1(0.7%)] was obese.

Table 2. Distribution of the studied cases according to BMI.

<table>
<thead>
<tr>
<th>BMI Level</th>
<th>Groups of study</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cancer</td>
<td>Healthy</td>
</tr>
<tr>
<td>(&lt;18.5)Underweight</td>
<td>No. 2</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>% 1.3%</td>
<td>5.3%</td>
</tr>
<tr>
<td>(18.5-24)Normal</td>
<td>No. 8</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>% 5.3%</td>
<td>14.7%</td>
</tr>
<tr>
<td>(25-29)Overweight</td>
<td>No. 13</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>% 8.7%</td>
<td>24.0%</td>
</tr>
<tr>
<td>(30≥40)Obese</td>
<td>No. 2</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>% 1.3%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Total</td>
<td>No. 25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>% 16.7%</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

MCP <0.01 (HS)

Distribution of the Studied Cases According to the Type of Masses & Its Location

The frequency of tumors according to its type and location was listed in Table 3 and 4. It is obviously that the left breast was more exposed for danger of BCa development (52(69.3%)] than right breast [23(30.7%)]. Moreover, Benign cases were more prevalent among left breast cases too [18(72%)]. On the basis of the type and tissue which more subjected for BCa, it was noticed that the Breast Ductal most affected tissue with mitogenic changes [54(72%)] in comparison with Lobular [1(1.3%)], Invasive [9 (12%)] or Mixed carcinoma types [11(14.7%)] and in highly significant fashion (MCP<0.01).

Table 3. Distribution of patients according to the location of cancer

<table>
<thead>
<tr>
<th>CA site</th>
<th>Studied groups</th>
<th>Chi-Square (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Breast cancer</td>
<td></td>
</tr>
<tr>
<td>Right breast</td>
<td>N 7</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>% 28%</td>
<td>30.7%</td>
</tr>
<tr>
<td>P=0.801</td>
<td>Non sign.</td>
<td>(P&gt;0.05)</td>
</tr>
<tr>
<td>Left breast</td>
<td>N 18</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>% 72%</td>
<td>69.3%</td>
</tr>
<tr>
<td>Total</td>
<td>N 25</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>% 100%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Table 4. Distribution of patients according to the type of cancer

<table>
<thead>
<tr>
<th>Type of CA</th>
<th>N</th>
<th>%</th>
<th>Chi-Square (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ductal CA</td>
<td>55</td>
<td>73.33%</td>
<td></td>
</tr>
<tr>
<td>Lobular CA</td>
<td>9</td>
<td>12%</td>
<td>P=0.001 Highly sign. (P&lt;0.01)</td>
</tr>
<tr>
<td>Mixed</td>
<td>11</td>
<td>14.67%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Validity of Tumor Marker Ca 15.3 & Vitamin D3

In order to evaluate the significance role of both Tumor marker Ca 15.3 and Vitamin D3 in BCa; Receiver Operation Curve (ROC) was applied and the results was embodied in Table 5:

Table 5. Validity of Ca 15.3 & Vitamin D3 in Breast Cancer development.

<table>
<thead>
<tr>
<th></th>
<th>CA15-3</th>
<th>Vitamin D3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>65.3%</td>
<td>57.3%</td>
</tr>
<tr>
<td>Specificity</td>
<td>54%</td>
<td>62%</td>
</tr>
<tr>
<td>Positive predictive value (PPV)</td>
<td>68.1%</td>
<td>69.4%</td>
</tr>
<tr>
<td>Negative predictive value (NPV)</td>
<td>50.9%</td>
<td>49.2%</td>
</tr>
<tr>
<td>Accuracy</td>
<td>60.8%</td>
<td>59.2%</td>
</tr>
<tr>
<td>Area Under the curve (AUC)</td>
<td>0.652</td>
<td>0.632</td>
</tr>
<tr>
<td>Cutoff value</td>
<td>≥ 14.8</td>
<td>≤ 17.6</td>
</tr>
<tr>
<td>P-value</td>
<td>0.004 HS</td>
<td>0.012 S</td>
</tr>
</tbody>
</table>

This table revealed highly significant importance for CA 15-3 in discrimination between BCa and healthy individuals (P= 0.004) with a cut-off value of ≥ 14.8 Pg/ml, even though the sensitivity (65.3%) was low and less specific (54%). Figure 1 represent the area under curve for CA 15-3 plotted from ROC analysis. On the other hand, Vitamin D3 seemed to be linked significantly with BCa (P= 0.012) while it showed higher specificity (62%) than tumor marker although its sensitivity was less (57.3%) so is accuracy (59.2%). Its optimum concentration was found to be ≤ 17.6 Pg/ml.

Figure 1. ROC curve analysis of CA-15-3 & Vitamin D3 in BCa subjects
Discussion

Breast cancer is usually detected in older age: More than half of all women with BCa are over 60 years old when it is first diagnosed. The age of disease onset is very critical factor upon which relay the survival of patients and her chance for responsive therapeutic schedule. The Iraqi studied sample revealed that the patients are at their fourth decade. They are younger than that for other investigation.

Considering age of patients, the current results showed that post-menopausal age is the risk stage of developing BCa. The results of the other referred to increasing risk of BCa with age, while Melvin et al. (2016) reported that the age of developing BCa enhance with its severity and earlier developing with positivity of family history. However, scientists declared that the menarche and menopause ages are important risk factors for developing BCa. The present results were appeared in consistency with the recent one. Previously, a study showed that the mean of age of benign breast mass among Iraqi females (26.9 ± 8.3 years) was lower than malignant cases (52.8 ± 12.3 years).

Regarding the obesity and the mean of BMI, the present study revealed that most BCa patients were over-weighed and these results comparable to the conclusions of others who reported that obesity decline the opportunity of BCa for survival and most of them either obese or over-weighed. Recent findings showed that every 5 kg/m² increase in BMI corresponded to a 2% increase in BCa risk in women. However, many risk factors may be participate in initiation of BCa and enhanced by the obesity. Obesity at pre- or post menopause may became a risk factor as previously mentioned since it affects the hormones levels. The present results were quite compatible with that for Chen et al. (2016) and they concluded that obesity acts mainly as an influential trigger for the development of late-onset BCa. Study of Oqab (2014) showed that no significant difference between the BMI for Iraqi females with BCa (27.3 ± 4.7Kg/ m²) and benign breast mass (27.6 ± 5.3 Kg/m²). These results agreed with the present data and the interpretation for the little variation may be related to sample size and different conditions affects Iraqi women during the past years.

From point of view of tumor marker CA 15-3, this study reveals its significance in association with carcinoma cases as well as with another study which recruited the significance of CA 15-3 as a diagnostic marker for BC and they reckoned serum levels of CA15-3 as a potential biomarker for BCa monitoring. When stratified by clinical stage, it was noticed that although malignant tumors in all stages show elevated levels of CA15-3, it is greatly associated with the tumor stage, as it increases as breast tumor stage worsens. These findings recently, Li and his colleagues reached too which was absolutely compatible with the current results.

Decrement in the level of Vitamin D3 among BCa patients support its crucial role in prevent and protection against BCa which reported recently by Atoum and Alzoughool (2017). The present data shared the researchers that the rising in incidence of BCa and high prevalence of vitamin D deficiency, reflected an association between serum vitamin D concentration and BCa risk, due to the link between vitamin D receptor genetic polymorphisms and BCa. However, there was another study that disagreed with the present conclusion which referred to little evidence for a linear causal association between circulating vitamin D concentration and risk of various types of cancer, and subsequently widespread vitamin D supplementation should not currently be recommended.

Furthermore, CA 15-3 level probably may be varied according to the location or type of the breast tissue that showed changes.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

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Study of Some Biochemical Parameters in Infertile Men

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¹College of Educational for Pure Science, Al Muthanna University, Iraq

Abstract

This study was carried out during the period 25-1-2017 to 20-3-2018 at Al-Sader Teaching Hospital in Najaf, to study the relationship between Leptin and some biochemical changes in infertile men. The patients groups ranged from (20-35), (36-45) and (46-55) years. The results showed no significant difference (p<0.05) in cholesterol level in infertile men within the age group (20-35). It was compared with the fertile men. While a significant increase (p<0.05) in cholesterol level in infertile men within the group (36-45), (46-55) compared with the fertile men. The result showed non a significant difference (p<0.05) in HDL level in infertile men within the infertile men within the age group (46-55) compared with the fertile men, while non-significant deference (p<0.05) in LDL level in in infertile men within the age groups (20-35), (36-45) compared with the fertile men.

Key words: Infertile, LDL, Men, Cholesterol and Biochemical

Introduction

Infertility is the inability to conceive after one year of uninterrupted sexual intercourse¹. Infertility is a common responsibility between male and female. For this reason, the marital status of the couple is evaluated together when the causes of infertility are studied ,some researchers believe that the responsibility for non-fertilization is equal in all genders. There are two types of infertility. The primary infertility is the lack of a pre-pregnancy. The secondary infertility is pregnancy, even once². The men are responsible for about 30% from infertility cases that belong to male factor and the women is responsible for about 30% from infertility cases that belong to female factor and consider both couple responsible for about 30% from causes called combined factor and remind 10% from infertility causes to be unexplained factor³. The most significant of these are low sperm concentration (oligospermia), poor sperm motility (asthenospermia), and abnormal sperm morphology (teratospermia). Other factors less well associated with infertility include semen volume and other seminal markers of epididymal, prostatic, and seminal vesicle function⁴. The problem with sperm count, motility, and morphology stems from disarray in control mechanism, including pre-testicular, testicular, and post-testicular factors⁵. Leptin is a protein that is produce from the white adipose tissue and newly discovered as a neurotransmitter hormone in various organs of the body, including the reproductive system. It is composed of fat cells that have an important role in body weight⁶. Leptin, a 16-kD adipocyte-derived cytokine, leptin is circulates in blood and work on the brain to energy expenditure and regulate food intake. When fat mass increases, leptin concentration increase, which suppresses appetite until weight is lost⁷. When fat mass decreases, plasma leptin concentration decreases⁸.

Aim of study: 1- Estimated the concentration of leptin and some biochemical parameter (cholesterol, high density lipoprotein, low density lipoprotein and triglyceride) in infertile men compared with control group.

2-Study study the correlation between leptin and some biochemical parameters.

Materials and Method

Subjects of the Study

Two studied achievable, included the first group consisted of fifty infertile men patients whom were selected from the infertility center of Al-Sader Teaching Hospital in Al-Najaf province from January, 2017 to March 2018. The second group was a healthy control which included of forty healthy fertile men of different ages, and they were divided in accordance
to the effect of some factors such as: type of infertile, sperm cases and the age were subdivided in to three groups in accordance with table (1).

**Table 1. Distribution sample according to age**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>No of sample</th>
<th>Healthy group</th>
<th>Patients group</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td></td>
<td>29</td>
<td>35</td>
</tr>
<tr>
<td>36-45</td>
<td></td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>46-55</td>
<td></td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>40</td>
<td>50</td>
</tr>
</tbody>
</table>

**Infertile Group**

The study included 50 men with infertility, 6 of them had azoospermia, 24 of them had oligozoospermia and 20 of them had Teratospermia. Samples Collection

**Seminal Fluid Sample**

Samples were collected by the masturbation method in a disposable container. It has a wide and inserted nozzle and without the use of any lubricating chemicals because it may contaminate the semen and affect its vitality.

**Blood Samples**

Blood sample of venous (5ml) were grouped from male of both healthy control and infertility. The serum acquired by reposing the blood sample in a clean dry plastic tube (does not contain anticoagulant) and allowable to clot at 37c for 30 minutes before centrifugation.

**Seminal Fluid Analysis**

The semen examination was conducted with the help of three specialists in the field of semen examination according to the method used in collection of laboratories, where the specimens were divided into oligozoospermia, which was a total count of sperm less than 20 million sperm¹.

**Bio Chemical Tests**

**LDL-Cholesterol**

The determine of human LDL-Cholesterol in human serum or plasma was performed according to using the spectrophotometer or by following equation LDL Cholesterol = Total Cholesterol – Triglycerides/5– HDL Cholesterol in mg/dl.

**HDL-Cholestrol**

The determine of human HDL-Cholesterol in human serum or plasma was performed according to using the spectrophotometer.

**Statistical Analysis**

The program used SPSS in the statistical analysis to study the different factors in the studied traits and ratios and compared the significant differences between the averages in the Z. test, While ANOVA was used to compare the differences between the studied ratios. The result was consider significant when p value was (p≤0.05) (10).

**Results**

The mean of Cholesterol in Infertile and Fertile men

The table (2) showed no significant difference(P≤0.05) in leptin level in infertile men within the age group(20-35). It was (3.4687±153.211) compared with the fertile men (3.3691±153.105) ,While notice a significant increase (P≤0.05) in leptin level in infertile men within the age group (36-45), (46-55). It was (3.2651±172.667), (3.5564±164.250) compared with the fertile men(2.6419±159.500), (2.5423± 157.750).
Table 2. The means of Cholesterol in Infertile and Fertile men

<table>
<thead>
<tr>
<th>Groups</th>
<th>Age groups (years)</th>
<th>Mean± S.E.</th>
<th>Infertile N=50</th>
<th>Fertile N=40</th>
<th>Z.test</th>
<th>P. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-35</td>
<td>153.211 ± 3.4687</td>
<td>153.105 ± 3.3691</td>
<td>0.010</td>
<td>0.998</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36-45</td>
<td>*172.667 ± 3.2651</td>
<td>159.500 ± 2.6419</td>
<td>3.997</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td></td>
<td>46-55</td>
<td>*164.250 ± 3.5564</td>
<td>157.750 ± 2.5423</td>
<td>2.253</td>
<td>0.018</td>
<td></td>
</tr>
</tbody>
</table>

(*)statistically significant differences (P≤0.05) between infertile and fertile men.

The mean of HDL in Infertile and Fertile Men.

The table (3) showed no a significant difference (P≤0.05) in HDL level in infertile men within the age group (20-35), (36-45) and (46-55). It was (0.6301 ±44.8947), (0.4131±44.0000) and (0.4802±43.7500) compared with the fertile men.

Table 3. The means of HDL in Infertile and Fertile Men.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Age groups (years)</th>
<th>Mean± S.E.</th>
<th>Infertile N=50</th>
<th>Fertile N=40</th>
<th>Z.test</th>
<th>P. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-35</td>
<td>44.8947 ± 0.6301</td>
<td>43.7368 ± 1.5725</td>
<td>-0.7330</td>
<td>0.486</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36-45</td>
<td>44.00000 ± .4131</td>
<td>45.1667 ± 1.3271</td>
<td>0.2780</td>
<td>0.803</td>
<td></td>
</tr>
<tr>
<td></td>
<td>46-55</td>
<td>43.7500 ± 0.4802</td>
<td>46.5000 ± 0.9574</td>
<td>0.4990</td>
<td>0.669</td>
<td></td>
</tr>
</tbody>
</table>

The mean of LDL in Infertile and Fertile Men

The table (4) showed a significant increase(P≤0.05) in LDL level in infertile men within the age group (46-55). It was (2.2015± 88.4000) compares with the fertile men (4.1118±78.7000) , while no a significant difference (P≤0.05) in LDL level in infertile men within the age groups (20-35), (36-45). It was (2.4404 ±73.5895), (3.6770 ± 95.9000) compares with the fertile men.

Table 4. The means of LDL in Infertile and Fertile men.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Age groups (years)</th>
<th>Mean± S.E.</th>
<th>Infertile N=50</th>
<th>Fertile N=40</th>
<th>Z.test</th>
<th>P. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20-35</td>
<td>73.5895 ± 2.4404</td>
<td>74.6737 ± 3.3699</td>
<td>0.124</td>
<td>0.922</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36-45</td>
<td>95.9000 ± 3.6770</td>
<td>92.9667 ± 3.5857</td>
<td>0.2970</td>
<td>0.784</td>
<td></td>
</tr>
<tr>
<td></td>
<td>46-55</td>
<td>*88.4000± 2.2015</td>
<td>78.7000± 4.1118</td>
<td>4.769</td>
<td>0.022</td>
<td></td>
</tr>
</tbody>
</table>

(*)statistically significant differences (P≤0.05) between infertile and fertile men
The means of Triglyceriol in infertile and fertile men

The table (5) showed a significant increase (P≤0.05) in Triglyceriol level in infertile men within the age group (46-55). It was (14.284±195.250) compared with the fertile men(10.275 ± 128.000 ). While no significant difference (P≤0.05) in Triglyceriol level in infertile men within the age groups (20-35), (36-45). It was (13.384±163.632 10.336±160.833) compared with the fertile men.

Table 5. The means of Triglyceriol in Infertile and Fertile men.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean± S.E.</th>
<th>Fertile N=50</th>
<th>Z.test</th>
<th>P. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age groups (years)</td>
<td>Infertile</td>
<td>N=50</td>
<td>Fertile</td>
<td>Z.test</td>
</tr>
<tr>
<td>20-35</td>
<td>13.384 ± 163.632</td>
<td>± 160.316 12.443</td>
<td>2.4650</td>
<td>0.132</td>
</tr>
<tr>
<td>36-45</td>
<td>160.833 ± 10.336</td>
<td>158.833 ± 11.557</td>
<td>1.468</td>
<td>0.417</td>
</tr>
<tr>
<td>46-55</td>
<td>*195.250± 14.284</td>
<td>128.000 ± 10.275</td>
<td>4.347</td>
<td>0.027</td>
</tr>
</tbody>
</table>

(*)statistically significant differences (P≤0.05) between infertile and fertile men

The correlation between leptin and cholesterol in infertile and fertile men

The table (6) showed no significant positive correlations between leptin and cholesterol (R=0.403) in infertile men, also showed no significant negative correlation between leptin and cholesterol (R=0.403) in fertile men. While notice a significant positive correlation between leptin in infertile and leptin in fertile and a significant positive correlation between leptin in fertile and cholesterol in infertile (R=0.403, P=0.05)

Table 6. Correlation between Leptin and cholesterol in infertile and fertile men.

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Leptin infertile</th>
<th>Leptin fertile</th>
<th>cholesterol infertile</th>
<th>cholesterol fertile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leptin infertile</td>
<td>1</td>
<td>*0.129</td>
<td>0.049</td>
<td>-0.276-</td>
</tr>
<tr>
<td>Leptin fertile</td>
<td>*0.129</td>
<td>1</td>
<td>*0.145</td>
<td>-0.049-</td>
</tr>
<tr>
<td>cholesterol infertile</td>
<td>0.049</td>
<td>*0.145</td>
<td>1</td>
<td>-0.296-</td>
</tr>
<tr>
<td>cholesterol fertile</td>
<td>-0.276-</td>
<td>-0.049-</td>
<td>-0.296-</td>
<td>1</td>
</tr>
</tbody>
</table>

*. Correlation is significant at the 0.05 level (2-tailed).

R^2=0.403  T. test=0.133

The between Correlation Leptin and HDL in Infertile and Fertile Men.

There is no significant negative correlation between leptin and HDL (r=0.703) in infertile. Also no significant positive correlation between HDL in fertile and leptin in fertile (r=0.703). While notice a significant positive correlation between HDL in infertile and fertile (r=0.703 , p=0.01)

Correlation The between Leptin and LDL in Infertile and Fertile Men

There is no significant positive correlation between leptin and LDL (R=0.391,P=0.05) in infertile and fertile men. Also showed a significant positive correlation between leptin in infertile and fertile men , between LDL in infertile and leptin in fertile men(R=0.391, P=0.05).
While notice no significant negative between leptin in infertile and LDL in fertile and between LDL in infertile and fertile men ($r=0.391$).

**Discussion**

The study current shown a high level cholesterol in patients within age group (11-12), (13 -14). The result of this study accordance with$^{15}$ who explain increases cholesterol can effect on sperm motility in rabbit. their findings are similar with our observation in infertile men cases. Also agrees with$^{16}$ who explain studies the occurrence of hypercholesterolemia in infertile men. The Cholesterol is forms of fat, or lipid, which circulate in the bloodstream. They are essential for life itself. Cholesterol is essential for building and maintaining key parts of cells (such as cell membranes), and for making several necessary hormones (aldosterone, sex hormone, etc.)$^{17}$. But when blood levels of cholesterol become too high, the risk of development cardiovascular disease is significantly increased and this is why the need to be connoted about lipid profile levels. cholesterol are augmented with obesity, which make the subject facing double risk to development cardiovascular disease and diabetes mellitus$^{18}$. The present study a highly positive correlation between leptin and cholesterol in infertile men. This means that leptin increased with increased cholesterol level. The result of$^{19}$ found that the study also examined whether Leptin and soluble Leptin receptor (OB-Re) are statistically related with lipid parameters among all study subjects. It was found that serum Leptin levels were positively correlated with cholesterol. While the result of this study disagreement with$^{20}$ who found serum lipids levels such as cholesterol were almost no correlation with semen parameter and infertility. As the world$^{21,22}$ explained there is no correlation between lipid profile and infertility. As well as explain the world$^{23}$ there is no significant relationship between lipid profile and leptin concentration. this study accordance with$^{19}$ found that the study also examined whether Leptin and soluble Leptin receptor (OB-Re) are statistically related with lipid parameters among all study subjects.

**Leptin and HDL**

The study current shown no a significant difference in HDL level in infertile men compares fertile men. Also the present study a highly negative correlation between leptin and HDL in infertile men. The result of this study agrees with$^{19}$ found that the study also examined whether Leptin and soluble Leptin receptor (OB-Re) are statistically related with lipid parameters among all study subjects. It was found that serum Leptin levels were negatively related with HDL. In contrast, it was demonstrated that a relationship between leptin concentration and lipid profile and lipoprotein levels among hyperlipidemia adult patients was not statically significant$^{20}$

**Leptin and LDL**

The current study shows a high LDL level in infertility men within age group (13-14). Also the present study a high positive correlation between leptin and LDL in infertile men. The result of this study agrees with the world studies that found the study also inspected whether Leptin and soluble Leptin receptor (OB-Re) are statistically correlated with lipid parameters among all study subjects. It was found that serum Leptin levels were positively correlated with LDL$^{19}$ While the result of this disaccord with$^{20,21}$ who observed that there was no correlation between serum lipid such as LDL and semen parameter and infertility. As well as explain the world$^{22,23}$ explained there is no correlation between lipid profile and leptin

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding

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Vitamin D Status With Obesity in Patients Attending Nutrition Clinic at Al- Sadiq Hospital

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1Babil Health Directorate Iraqi Ministry of Health, Iraq

Abstract

Our aim from this study is to contribute to the unveiling process of the hidden problem of vit d deficiency and its relation with increase body weight through our work in nutrition clinic at al sadiq hospital in hilla city. Since the association between vit d deficiency and obesity is well known but the mechanisms are not fully understood, and because vit. D deficiency considered nowadays as a pandemic and has been implicated in several diseases, and because of its proved negative impact on general health, researches and studies should keep going conducted on this issue.

Keywords: Vitamine D, Obesity, Nutrition

Introduction

A major health issue linked with Vitamin D is the growing obesity rate. WHO states that in 2014 more than 1.9 billion adults were overweight, of which 600 million were obese.

Vitamin D is a steroid that has a hormone-like activity responsible for regulating over 200 genes functions in the body; likewise, it is indispensable for growth and development of the human body. Vitamin D is synthesized in the skin by the action of sunlight containing ultraviolet B (UVB) radiation. Dietary sources are essential when exposure to sunlight containing the appropriate wavelength is limited.

A study involving 243 adults reported a decrease of 0.74nmol/l of serum 25D per 1kg/m2 increase in BMI. Several theories have been proposed to explain why obese individuals demonstrate lower circulating 25OHD concentrations than their healthy-weight counterparts, the most plausible being sequestration of fat-soluble vitamin D within excess adipose tissue. Obese individuals often conduct a sedentary lifestyle, less outdoor activity, and cover-up more when outdoors compared with their lean or normal-weight counterparts, thus limiting the endogenous production of cholecalciferol in the skin.

Air pollution constitutes an independent risk factor in the pathogenesis of both obesity and low vitamin D status, in combination with unhealthy diet and lifestyle.

The satiety hormone leptin, secreted by adipocytes, is positively correlated with the amount of body fat and reflects energy status. Leptin interact with vitamin D receptor (VDR) to control lipid metabolism through inhibition of lipogenesis and stimulation of lipolysis, 1α,25(OH)2D3 directly stimulated secretion of leptin in mouse adipose tissue cultures. Thus, the vitamin D3 depletion might increase appetite and lead to obesity.

The current evidence supports the hypothesis that normal vitamin D status, 25-OH vitamin D above 30 ng/mL (>75 nmol/L), improves the metabolic aspects, such as obesity.

Materials and Method

Serum vit d level measured by chemiluminece immunoassay. Vit d assay is a two incubation chemiluminece immunoassay for the quantitative determination of total 25-OH vitamin d in human serum.

Statistics

Statistical analysis was done using spss software.

Statistical methods
Chi square test, Frequency, Mean, Median, Standard deviation

**Results**

In the current study the total number of participant was (89), of which about 75% female (n=67) and 25% male(n=22).

Mean vit d level was (13.862921 ± 8.6709203 SD)

Overall vit D deficiency (< 20ng/ml) was 80.9%, of which 14% have vit D level <10ng/ml, and 39% have level between (10 – 20ng/ml). 64% of females have vit D deficiency (< 20ng/ml), while 16.8% of males have vit D deficiency (< 20ng/ml) (Table 1).

**BMI distribution of the study participants:**

The highest percentage 39%(n=35)were in group3 (30 -40 BMI), Mean BMI was (35.02), median was (35.00), SD (10.049).

60.5% of the obese (BMI ≥ 30) have vit d deficiency, while only 7.8% of normal weight (BMI between 25 -29.9) have vit d level <20ng/ml (Table 2).

Distribution of the participants according to vit d levels

The highest percentage 37(42%) were in class 1 deficiency (10-20ng/ml), 35 (39%) were in zero group (<10ng/ml), 11 (12%) in class2 deficiency (20-30ng/ml), and only 6 (7%) of participants were in class 3 normal level of vit d (>30 ng/ml) (Table 2) (Figure 1).

### Table 1. Gender * vit D3 class

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
<th>P</th>
<th>Count</th>
<th>8.6%</th>
<th>32.4%</th>
<th>45.5%</th>
<th>33.3%</th>
<th>24.7%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>Count</td>
<td>35</td>
<td>37</td>
<td>11</td>
<td>6</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>% within vit D3 class</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. BMI classes * vit D3 classes

<table>
<thead>
<tr>
<th>BMI class</th>
<th>vit D3 class</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>insufficiency</td>
<td>normal</td>
</tr>
<tr>
<td>under weight</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>% within BMI class</td>
<td>33.3%</td>
<td>33.3%</td>
</tr>
<tr>
<td>normal weight</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>% within BMI class</td>
<td>42.9%</td>
<td>57.1%</td>
</tr>
<tr>
<td>over weight</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>% within BMI class</td>
<td>22.2%</td>
<td>55.6%</td>
</tr>
<tr>
<td>Obesity</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>% within BMI class</td>
<td>28.6%</td>
<td>42.9%</td>
</tr>
<tr>
<td>morbid obesity</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>% within BMI class</td>
<td>61.9%</td>
<td>28.6%</td>
</tr>
<tr>
<td>supper morbid obesity</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>% within BMI class</td>
<td>45.5%</td>
<td>45.5%</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>% within BMI class</td>
<td>39.3%</td>
<td>41.6%</td>
</tr>
</tbody>
</table>

Figure 1. Distribution of BMI classes according to vit. D levels

Discussion

This study conducted on attendants to nutrition clinic at al-sadiq hospital during winter time. Blood levels of vitamin D in humans vary by season\textsuperscript{14,15}.

Also old age, female gender, multi-parity, clothing style, low socioeconomic status and urban living have consistently been associated with low levels of vitamin D in the literature\textsuperscript{16} so these may affect the results of our study. Further integrative studies needed to address these issues.

We observed that mean vit d3 level was (13.9 $\pm$ 8.8ng/ml) despite of living in sunny country, and since the majority of our study sample was females (75%) so this result agree with a cohort from the middle east conducted in Arab Emirates which reveals that , winter vit D level in females found to be 13.3 $\pm$ 12.3 ng/ml, While the average vit D level during summer was 20.9 $\pm$ 14.9 and 27.3 $\pm$ 15.7 ng/ml in female and male respectively\textsuperscript{17}.

According to gender, Blood levels of vitamin D in humans vary by gender \textsuperscript{19} like other studies in Arab region, our results showed that higher percentage of women has lower level of vit d( 63%) compared to men(16%) due to high body fat composition and effect of child bearing\textsuperscript{18,20,21}.

Interestingly, our results disagree with a study conducted in Arab Emirates on 260 adults in which both men and women exhibited similar rates of vitamin D deficiency\textsuperscript{22}. 
Clothing style of Emirati men (covering allover the body) could be the explanation for similar rates of vit d deficiency between Emirati men and women.

A meta-analysis in Iran showed that the prevalence of vitamin D deficiency among male, female, and pregnant women was 45.64%, 61.90%, and 60.45% respectively and these results support our observation regarding gender difference in vit d deficiency.

A study conducted on Omani women agree with our results regarding gender.

In the elderly Lebanese, 37% of men and 56% of women had vitamin D levels below 25nmol/L.

A study from Jordan stated The prevalence of low vitamin D was 37.3% in females while 5.1% in males. Dress style in females was independently related to low vitamin D status; women wearing ‘Hijab’ or ‘Niqab’ were at a higher risk for low vitamin D status than were western-dressed women.

In term of age, Blood levels of vitamin D in humans vary by age.

Our study suggest that vit D deficiency (≤ 20 ng/ml) was higher in late adolescents and young adults (48.3%) and (11%) in younger age group, with overall percentage with older adult was 67.4%, and this result agree with the result from a cohort in arab emirates.

vitamin D deficiency is increasingly recognized as an endemic condition in adults with global variations in the prevalence of vitamin D deficiency.

Regarding obesity, Blood levels of vitamin D in humans vary by body mass index.

We observe that 60.5 % of obese participants (BMI ≥ 30) have vit d (< 20 ng/ml), and these results supported by a study conducted in arab emirates.

47.1% of Obese females have vit D deficiency(< 20 ng \ml), while 6.7% of overweight females have vit d deficiency.

Study in USA concluded that lower 25(OH) D concentrations were associated with lower adiponectin concentrations and higher BMI and waist circumference(P<0.05for all).

Our results explore that there is no significant association between BMI and vit d deficiency in females and this may explained by small sample size (n= 89) and small number of normal weight participants in our sample (n= 6) that may not represent normal weight females. And because the attendants to our nutrition clinic were mostly obese.

Additionally, those normal weight participants may have vit d deficiency lately and may develop obesity in the future. A recent meta-analysis study reported the vitamin D deficiency was associated with obesity irrespective of age, latitude, cut-offs to define vitamin D deficiency and the Human Development Index of the study location. However, Saneei P et al. included 34 studies in the meta-analysis, and their results support a significant inverse weak correlation between serum 25(OH) D levels and BMI in adult population.

The institute of medicine (IOM) proposed that serum 25(OH) D levels above 20mg/ml (>50 nmol\L) are adequate. However, the endocrinology society considers that serum 25(OH) D levels over 30 ng/ml (≥75 nmol/L) are optimal.

Interestingly, there is a variation in the international cutoff levels of adequate vit d, and this may bring a question about the applicability of those levels on our population.

Conclusions

Vitamin D deficiency is endemic in our population. It impacts all age groups and both genders. However, women are at a higher risk which calls for further studies and intervention programs. Having the prevalence of 80.9% could raise question whether the international cutoff points fit our region’s population or not?

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

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Bacteriological Study of Tonsillitis Patients and Estimation of Concentrations of Certain Immunological Parameters

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Abstract

Tonsillitis is one of the most common conditions of the upper respiratory tract infections and occurs as a result of an infection mediated by bacteria, viruses, chlamydia and fungi. The inflammation is accompanied by sudden pain in the throat and pain when swallowing. The causes of inflammation of the tonsils are related to the severity of the variability of the cause, as there are many causes, including germ and other may be caused by the diseases associated with the association was in the study collected 100 swabs of people with tonsillitis at Hilla Teaching Hospital at the same time collected (100) blood samples for the purpose of serological study.

The results showed the highest rate of infection in females by 70% compared to males, which was 30%. The bacteriological study included all the swabs were cultured in different media for the purpose of determining the bacterial species. The highest percentage of gram positive bacteria was recorded at 78% while the percentage of Gram-negative bacteria was 22%. Of these species, three bacterial strains were Staphylococcus aureus (18%) and Streptococcus spp. By 34% and Klebsiella pneumonia by 0.4%.

The incidence of tonsillitis was distributed during the current study in the various age groups, which ranged from (8-47) years. The age group (18-27) had the highest incidence rate of 72% while the lowest rate of infection in the age group (46-42) %,

Immunological tests for patients with tonsillitis showed increased concentration of IL-6 at different age groups for all patients compared to control and the highest concentration of them in the age group 18-27 years (5.946 ± 0.001 pg/ml), While the positive results for C.R.P test was only 8.7% of the total infected samples and its concentration was 12 mg / dl.

We infer the existence of systematic and local immune response against infection with tonsillitis.

Aim of the study: Investigation of bacterial species causing tonsillitis, their pharmacological sensitivity and assessment of concentrations of certain immunological parameters

Keywords: immunological parameters; tonsillitis patients; Bacteriological study; and respiratory

Introduction

The tonsils are pieces of lymphoid tissue that contain many lymphocytes, especially B-cells, which are responsible for the secretion of antibodies and are usually associated with human infection centers1. They are susceptible to infection by several microbes such as viruses, bacteria, chlamydia and fungi, causing a condition known as tonsillitis. The tonsils represent the first line of defense in the immune system of the human body, acting as a physical and chemical barrier of microbes, in addition to the secretion of antibodies and the stimulation of lymphocytes B and T to secrete cytokines to activate the humoral and cellular immune pathways to reduce the growth and spread of microbes2,3.
Infection of the tonsils is one of the most common cases of upper respiratory tract disease infections. At first inflammation occurs swelling of the pharyngeal tissue, which interferes with the entry and exit of air in the respiratory system, while the tonsils are swollen and red with a cover of gray or yellow on the surface and is usually accompanied by pain in the throat. When the inflammatory state develops, clinical symptoms include fever, chills, general fatigue, pain in the ear and mouth when swallowing, swelling of the lymph nodes in the neck and when diagnosed by the doctor, there are red or white spots on the tonsils surface, symptoms persist for 4-6 days. The incidence of tonsillitis in children aged 4-12 years caused by bacteria and usually treated with antibiotics, but this procedure may not work when the situation is chronic and therefore require surgical intervention to eradicate.

Bacteria play main role in inflammation of pharyngitis and tonsillitis. Streptococcus is the most common type of gram positive, while gram negative bacteria are low in appearance due to bacteriological cultures.

The tonsils one of organs that refer to local immunity and systemic immune response by activated Th-2 to produce cytokines. C-reactive protein is an early reliable indicator of inflammation or infection as it is released from the liver and begins to rise in blood within 6-12 hours of acute tissue inflammation. IL-6 one of immunoregulatory cytokines groups which stimulate in tonsil inflammation with significantly increased of its concentration within each age group of patients.

**Materials and Method**

A total of 100 swabs were collected from 100 patients suffering from tonsillitis at Hilla Teaching Hospital for the period from 1/11/2017 to 15/3/2018. At the same time, 100 blood samples were collected for the immunological study. A single swab was taken from patients using Sterile Swabs media according to standard routine procedures. The samples were transferred to the Microbiology Laboratory at the College of Science for women for culture and diagnosing the bacteria. Each sample separately were cultured on (MacConkey agar, Blood agar, Manitol salt agar, Neutreiant agar and Brain hart infusion broth) under sterile conditions and samples were obtained for 18-24 hours at 37°C after incubation. Bacterial growth of most samples was performed. Repeated sub culture to obtain pure isolates and to diagnose bacterial isolates visually and microscopically using the method of.

The IL-6 and C-reactive protein leveles were determined after separation of serum (5 mL) blood samples were placed in plastic tubes at 3000 rpm centrifuge and the serum patients were stored at -4°C to freeze and collect them to determine the concentration of IL-6 by ELISA and C-reactive protein as quantitatively and qualitatively according to the manufacturer’s instructions For the kit.

**Statistical Analysis**

Using the U.S. Census (SPSS11) to perform statistical analysis, as analyzed the results using the design random full-scale analysis of variance and adopted the test less significant differences Least significant difference test (LSD) and table analysis of variance (ANOVA Table) below the level of significance 0.05.

**Results and Discussion**

The current study was conducted on 100 people suffering from tonsillitis of both sexes and for all ages for the period from 1/11/2015 to 15/3/2016. The highest percentage of infection was recorded in females by 70% and 30% for male (Fig. 1). The current study showed that the samples that gave a positive result for bacteriological cultures were 78% while 22% gave a negative result (Fig. 2).
The positive result of the bacterial culture is important to determine the type of antibiotic for the treatment, although sometimes it does not give a valid result of the diagnosis as many studies have indicated that the results of the transplant interfere with the normal flora, and the negative result of the transplant may indicate that the causative agent of non-bacterial infection is viral or fungal.

The infection was divided between the different age groups, which ranged from (8-47) years. The highest percentage of infection was found in the age group (18-27) years. It was the highest rate of 72%, followed by the age group (28-37) the lowest incidence rate in the age group (38-47) was 2% (Fig.3).

Our results are consistent with other studies indicating that tonsillitis is more prevalent in the age group (11-20) years and prevalence among females than males.

Gram positive bacteria showed the highest rate of bacterial expression of swabs from the tonsils compared to gram negative bacteria (97.4% and 2.6%, respectively) (Fig.4).

However, isolation from the tonsil surface cannot always reflect real pathogens. The Jayasimha (2013) study found that the implantation of the inner layer of the tonsils gives a different result to the external layer. Some species interfere with the normal flora of the upper respiratory tract, and internal bacteria play a main role in the recurrence of inflammation because no appropriate antibiotic is identified and therefore only treatment for surface bacteria.

The results of our study showed that the samples that gave a positive result to examine the concentration of effective C-reactive protein were 8.7% at a concentration.
of 12 mg / dl while 91.3% gave a negative result (Fig. 5).

![Figure 5. Rate of results for CRP test](image)

The results of the present study indicate that the C-reactive protein does not increase during tonsillitis and that the samples given positive result of the examination may be due to the possibility of infection of other people that interfere with tonsillitis. However, the measurement of C-reactive protein is not the only major factor in diagnosis Tonsillitis.

The results of the current study increased significantly (P <0.05) in the level of concentration of IL-6 and for all age groups of patients compared to control its subsidiaries through the use of technology calibration absorbance linked immunoassay Enzyme -Linked Immunosorbent Assay (ELISA), and the highest its levels appear at the age group of 18-27 (Table 2).

<table>
<thead>
<tr>
<th>age group</th>
<th>Groups</th>
<th>Concentration of IL-6 pg/ml Mean ± S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-17 y</td>
<td>Control</td>
<td>3.761 ± 0.816</td>
</tr>
<tr>
<td></td>
<td>infection</td>
<td>5.944 ± 0.0005*</td>
</tr>
<tr>
<td>18-27 y</td>
<td>Control</td>
<td>4.449 ± 0.761</td>
</tr>
<tr>
<td></td>
<td>infection</td>
<td>5.946 ± 0.001*</td>
</tr>
<tr>
<td>28-37 y</td>
<td>Control</td>
<td>2.578 ± 0.462</td>
</tr>
<tr>
<td></td>
<td>infection</td>
<td>5.945± 0.001*</td>
</tr>
<tr>
<td>38-47 y</td>
<td>Control</td>
<td>3.276 ± 0.428</td>
</tr>
<tr>
<td></td>
<td>infection</td>
<td>5.945 ± 0.001 *</td>
</tr>
</tbody>
</table>

*L.S.D under (P<0.05) = 0.130

Present studies pointing to the concentration of IL-6 in the tissue is a result of local overproduction because of monocyte-macrophages activation, caused by repeated stimulation by pathogenic agents. Thus, Respond to infection tonsils starts production of Th-1 type cytokines, including most important IFN-γ and TNF-α, and later secrete Th -2 type cytokines (IL-4, IL-6, etc.). Numerous studies related to testing of the immune function in palatine tonsils, i.e. the share in local and systemic immunity, have shown that even damaged tonsils may preserve immune competence.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding

**References**


Histopathological Study on Stomach of Albino Mice Infected with *Streptococcus pneumonia*

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Abstract

The current study aimed to find out the effects of bacteria *Streptococcus pneumonia* on gastric tissue of mice.

Thirty albino mice (30-35 g) divided into three groups, the first group was control, the second group received *Streptococcus pneumonia* suspension for two weeks and the third group received *Streptococcus pneumonia* for one month for histopathological study on stomach. The animals were orally received *Streptococcus pneumonia* orally for one month.

The histopathological changes characterized by acute cellular swelling, infiltrations of mononuclear inflammatory cells, hyperplasia, partial loss of parietal and chief cells, atrophy in the mucosal and submucosal layers.

It can therefore be concluded that *Streptococcus pneumonia* has effect on others organs not only on lungs.

**Keywords:** histopathological, mice, stomach, *Streptococcus pneumonia*

Introduction

*Streptococcus pneumonia* is gram positive alpha hemolytic (under aerobic condition) or beta hemolytic (under anaerobic condition) facultative anaerobic member of the genus streptococcus. Gastric ulcers are open sores that develop on the lining of the stomach benign lesions that develop at sites in which the mucosal epithelium is exposed to acidic gastric juice. It is now considered a modern age epidemic, affecting approximately 10% of the global population. Gastric ulcers are induced by many factors, such as stress, smoking, alcohol, nutritional deficiencies and noxious agents. Most gastro protective drugs, Such as antacids, Hz receptor blockers, anti-cholinergic or proton pump inhibitors, act on the offensive factors to neutralize acid secretion. Clinical reports on these drugs have demonstrated that adverse effects and drug interaction occur during ulcer therapy.

Materials and Method

Experimental animals

Total 30 albino mice with three months age and body weight ranged between 30 and 35 g were used to perform the present study. Animals were housed in plastic cages of 60x10x10 cm³ dimensions in histopathology laboratory in AL-ESRAA University college and given standard rodent diet (commercial feed pellets) and drinking water were given. Housing condition were maintained at 22± 25°C, with controlled lightening using automatic electrical timer providing daily light of twelve hour (7.00 Am to 19.00 Pm) and twelve hour night cycle. The litters of the cages were changed every seven days.

Preparation of bacterial suspension:

First grow a culture in growth medium d then harvest the cells by centrifugation at 4000 rpm and 4 degree centigrade for 10 minutes. Now using an optical density meter o prepare the inoculum of the population size. Usually optical density of 0.5 at 550 nm wavelength equates 10E6-8 cell/ mL.
Experimental Design:

Animals were randomly divided into 3 groups of mice each consisting of ten animals, the first group was control received normal diet and water only, the second group receive *streptococcus pneumonia* for two weeks and the third group received *streptococcus pneumonia* for a month.

Collection of tissue samples:

Twenty four hours (day 15) after the last dosing of the second group, the animals were sacrificed and samples were collected and preserved in formaldehyde. And 42 hrs (day 31) after last dosing of the third group, the animals were sacrificed and samples were collected and preserved in formaldehyde.

Histopathological preparation of tissue:

After collecting the samples, they were immediately fixed in 10 % formalin. The tissues were then cut in slabs of about 0.5 ml transversely and the tissues were dehydrated by passing through different grades of alcohol. 70 % alcohol for 2 hours, 75 % alcohol for 2 hours, 100 % alcohol for 2 hours and finally 100 % alcohol for 2 hours. The tissues were then cleared to remove the alcohol; the clearing was done for 6 hours using xylene. The tissues were then infiltrated in molten paraffin wax for two hours in an oven at 57 °C. Thereafter the tissues were embedded. Serial sections were cut using rotary microtome at 5 micron (5μm) up from water.

The satisfactory ribbons used were picked from a water beta (50 - 55°C) with microtome slide that has been coated on one side with egg albumin as an adhesive and the slides were dried in an oven. Each structure was deparaffinised in xylene for 1 minute before immersed in absolute alcohol for 1 minute and later in descending grades of alcohol for about 30 seconds each to dehydrate it. The slides were then rinsed in water and immersed in alcoholic solution hematoxylin for about 18 minutes. The slides were rinsed in water, then differentiated in 1 % acid alcohol and then put inside a running tap water to blue and then counter stained in alcoholic eosin for 30 seconds and rinsed in water for a few seconds before being immersed in 70 %, 90 % and twice in absolute alcohol for 30 seconds, each to dehydrate the preparations. The preparations were cleared of alcohol by dipping them in xylene for 1 minute. Each slide was then cleared, blotted and mounted with DPX and cover slip and examined under the microscope. Photomicrographs were taken at ×400 magnifications.

Results:

Figure 1 show the cross section of stomach of control mice. Figure 2 and 3 show cross section of stomach of infected mice with *streptococcus pneumonia* after 2 weeks. Figure 4 show cross section of stomach of infected mice with *streptococcus pneumonia* after a month.

Figure 1. Stomach tissue of control group (normal tissue).

Figure 2. Stomach tissue of mice received *streptococcus pneumonia* for two weeks (group 2) show hyperplasia of lining epithelium, infiltrations of mononuclear inflammatory cells in the mucosa.

Figure 3. Stomach tissue of mice received *streptococcus pneumonia* for two weeks (group 2) show partial loss of parietal and chief cells, atrophy of mucosal layer.

Figure 4. Stomach tissue of mice received *streptococcus pneumonia* for month complete loss in parietal and chief cells with presence of ulcer and intestinal metaplasia.
Discussion

In the current study the presence of infiltration of mononuclear inflammatory cells is due to chronic gastritis which extend to cause hyperplasia in stomach\textsuperscript{3,4,5}. The dysplasia and metaplasia in the stomach occur due to chronic irritation, these changes are reversible and can return to normal as soon as the infection removed but if the infection persist for long time will cause cancer. The develop of ulcer is usually due to toxemia in the stomach\textsuperscript{6,7}.

Conclusion

From the present results obtained in this study provide that \textit{streptococcus pneumonia} cause ulcer in stomach after a month.

Acknowledgment: The authors are very grateful to the dean of AL-ESRAA University College and techniques analyzes for the technical support provided.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

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Funding: Self-funding

References

Effects of Non-Surgical Periodontal Treatment on Tumor Necrosis Factor-Alpha Serum Level in Patients with Type 2 Diabetes Mellitus and Chronic Periodontitis

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Abstract

Regarding the clinical periodontal parameters, PLI and GI at the baseline were highest in CP group followed by CPDM group then the control group, while PPD and RAL were highest in CPDM group followed by CP. Highly significant differences were found between CPDM and CP groups except for GI which showed non-significant differences. TNF-α level at the baseline were highest in CPDM group followed by CP group then the control group. After treatment, results revealed a reduction in all of the clinical periodontal parameters and TNF-α level for both CPDM and CP groups. The correlation between the clinical periodontal parameters and TNF-α level showed almost a non-significant week positive correlation

Keywords: Periodontitis, type 2 diabetes mellitus, tumor necrosis factor-alpha, nonsurgical periodontal therapy.

Introduction

Chronic periodontitis (CP) is an inflammatory disease that initiated by the accumulation of a pathogenic dental plaque biofilm above and below the margin of the gingiva, and within which microbial imbalance leads to a chronic irreversible and destructive inflammatory response.

It represents a consequence of local infections in the oral cavity resulting in irreversible destruction of the tooth supporting apparatus such as alveolar bone, root cementum, and the periodontal ligament.

Diabetes mellitus (DM) is defined as a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. Type 2 diabetes (T2DM) is characterized by insulin resistance mainly by altered insulin production but with certain capacity for insulin production without autoimmune destruction of β-cells and represent approximately (90%-95%) of diabetic population.

Patients with T2DM have a higher predisposition to periodontitis and hyperglycemia plays a significant role in increasing the severity of the periodontal status in diabetic patients. Diabetes considered as one of the primary risk factors for periodontitis. Cytokines is small proteins mediators which produced by the immune cells, it can act on several cells and play a variety of roles including inflammation and cellular differentiation and host defense against microorganisms.

Tumor necrosis factor-alpha (TNF-α) is a pro-inflammatory cytokines which is secreted as a response to bacterial stimulation by a variety of cell types. It stimulates osteoclasts differentiation and together with IL-1 may result in bone resorption. In periodontitis, up-regulated pro-inflammatory cytokines contribute to periodontal tissue destruction. Patients with periodontitis have increased serum levels of inflammatory cytokines, while diabetic patients have hyper inflammatory immune cells that can aggravate the increased production of inflammatory cytokines.

Materials and methods: Samples in this study consisted of ninety males and females with age range of (35-55) years. The subjects recruited for the study were patients attending the diabetes and endocrinology center.
in Nasiriayah city, as well as, patients from periodontics department and diagnosis department in the specialized dental center in Nasiriyah city. All the individuals were informed about the purposes of the study and consented to its protocol. The subjects were divided into:

1- Control group:- Thirty subjects with clinically healthy periodontium and healthy systemic status.

2 - CPDM group:- Thirty patients diagnosed to have chronic periodontitis and type 2 diabetes (T2DM). The patients in CPDM group were diagnosed according to American Diabetes Association criteria in 2017 (15).

3 – CP group:-Thirty patients diagnosed to have chronic periodontitis only and didn’t have DM.

Chronic periodontitis in patients was defined as the presence of four sites with probing pocket depth ≥4mm with clinical attachment loss ≥1-2mm, this made according to the international classification system for periodontal disease (16).

Inclusion criteria include T2DM patients on oral hypoglycemic medication, with normal body mass index level ranges between 18.5 kg/m² - 24.9 kg/m² (17), all subjects had at least 20 teeth.

Exclusion Criteria include pregnant ladies, smoking and other systemic diseases and patients who have undergone periodontal treatment and course of anti-inflammatory or antimicrobial therapy 3 months prior to the study. Initial examination was carried out consisting of evaluation of periodontal condition of the teeth and after selecting the suitable patients for the study, blood samples were taken, five ml of venous blood sample were aspirated from antecubital vein of each individual, using disposable plastic syringes with 23 gauge stainless steel needle. The whole blood was collected in sterile disposable plain tubes. After collection of the whole blood, leaving it undisturbed at room temperature, then centrifuging at 3,000 rpm for 20 minutes and aspirated and transferred immediately into another tube and frozen at(-15 Cº) for subsequent analysis. Haemolyzed samples were discarded. An alginate impression was taken and an occlusal stent was constructed for each patient in CPDM and CP groups. After completion of occlusal stent construction, the patients recalled for clinical periodontal parameters recording and they received thorough scaling and polishing with a good motivation and instructions in oral hygiene measures including brushing, using dental floss and interproximal brushes as indicated. The patients in CPDM and CP groups where recalled one week after scaling and polishing and the sites with periodontal pockets were treated by root planing. After root planing, the root surfaces were carefully inspected to evaluate the adequacy of the procedure. The patients in CPDM group were advised to follow the instructions rendered by their physician regarding medication and food prior to the procedure. The treatment procedures were kept short and as atraumatic as possible. After 8 weeks, patient in groups CPDM and CP groups were recalled for further collection of blood samples and recording clinical periodontal parameters.

The clinical periodontal parameters recording include:

1. Assessment of the soft deposits via Plaque Index (PLI) (18).

2. Assessment of the inflammation in the gingiva via Gingival Index (GI) (19).

3. Assessment of probing pocket depth (PPD).

4. Assessment of relative attachment level (RAL).

Results

A-Clinical periodontal parameters: Figure 1, 2 and 3 showed the mean values of periodontal parameters PLI, GI of the control group, PLI, GI, PPD, RAL of CPDM and CP groups respectively at base line and after treatment.

At the baseline, the highest value of PLI was found in CP group (1.8543) followed by CPDM group (1.6041) and then control group (0.2920). Regarding GI, the highest value was found in CP group (1.9295) followed by CPDM group (1.9017) then the control group (0.3233). The highest value of PPD was found in CPDM group (4.6973) followed by CP group (4.2901) and the highest value of RAL was found in CPDM group (7.4983) followed by CP group (7.1337).

Highly significant differences were found between CPDM and CP groups except for GI which showed non-significant differences (Table 1). After treatment, all of the clinical periodontal parameters decrease in both CPDM and CP groups. PLI, GI and PPD showed non-significant differences between the two groups, while RAL showed highly significant difference (Table 2).
B- Immunological findings: At the baseline, the highest value of TNF-α level were found in CPDM group (10.4647) followed by CP group (9.7807) and then control group (5.8393) (Table 3) with highly significant differences between each pairs of studied groups (Table 4). After treatment, TNF-α level decrease significantly in both CPDM and CP group (Table 5).

C- Correlation between TNF-α level and the clinical periodontal parameters: There were a non-significant weak positive correlations between all of the clinical periodontal parameters and the level of TNF-α among all of the study groups (Table 6).

Table 1: Intergroup comparisons for the mean and mean of difference values of clinical periodontal parameters between CPDM and CP groups at the baseline.

<table>
<thead>
<tr>
<th>Indices</th>
<th>status</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Mean of diff</th>
<th>t-test</th>
<th>sig</th>
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<td>Pl1</td>
<td>CPDM</td>
<td>1.6041</td>
<td>0.18693</td>
<td>0.25023</td>
<td>4.058</td>
<td>0.0001</td>
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<tr>
<td></td>
<td>CP</td>
<td>1.8543</td>
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<td>-0.25023</td>
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<tr>
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<td>CPDM</td>
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<td>-0.02787</td>
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<tr>
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<td>CP</td>
<td>1.9295</td>
<td>0.29707</td>
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<tr>
<td>PPD1</td>
<td>CPDM</td>
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<td>0.40720</td>
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<td>0.40720</td>
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<tr>
<td>RAL1</td>
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<td>7.4983</td>
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<td>0.36467</td>
<td>3.363</td>
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<tr>
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<td>CP</td>
<td>7.1337</td>
<td>0.37299</td>
<td>0.36467</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2: Intergroup comparisons for the mean and mean of difference values of clinical periodontal parameters between CPDM and CP groups after treatment

<table>
<thead>
<tr>
<th>Indices</th>
<th>status</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Mean of diff</th>
<th>t-test</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI2</td>
<td>CPDM</td>
<td>0.9523</td>
<td>0.11032</td>
<td>-0.00067</td>
<td>-0.022</td>
<td>0.983</td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>0.9530</td>
<td>0.12388</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GI2</td>
<td>CPDM</td>
<td>1.0927</td>
<td>0.08313</td>
<td>0.04887</td>
<td>2.367</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>1.0438</td>
<td>0.07668</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPD2</td>
<td>CPDM</td>
<td>3.5347</td>
<td>0.47972</td>
<td>0.07667</td>
<td>0.676</td>
<td>0.501</td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>3.4580</td>
<td>0.39408</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAL2</td>
<td>CPDM</td>
<td>6.2407</td>
<td>0.52339</td>
<td>0.36157</td>
<td>2.874</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>5.8791</td>
<td>0.44804</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Mean values of TNF-α level among studied group at the baseline and after treatment

<table>
<thead>
<tr>
<th>status</th>
<th>TNF-α 1</th>
<th>TNF-α 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Control</td>
<td>5.8393</td>
<td>1.37586</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>CPDM</td>
<td>10.4647</td>
<td>0.83956</td>
</tr>
<tr>
<td>CP</td>
<td>9.7807</td>
<td>0.46966</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>ANOVA</td>
<td>199.026</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
Table 4: Intergroup comparisons for the mean of difference values of TNF-α level among the studied groups at the baseline

<table>
<thead>
<tr>
<th>(I) status</th>
<th>(J) status</th>
<th>Mean of Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>CPDM</td>
<td>-0.68397*</td>
<td>0.25026</td>
<td>0.008</td>
<td>-1.1814-0.1865</td>
</tr>
<tr>
<td>CP</td>
<td>Control</td>
<td>3.94137*</td>
<td>0.25026</td>
<td>0.000</td>
<td>3.4439-4.4388</td>
</tr>
<tr>
<td>CPDM</td>
<td>CP</td>
<td>0.68397*</td>
<td>0.25026</td>
<td>0.008</td>
<td>0.1865-1.1814</td>
</tr>
<tr>
<td>CPDM</td>
<td>Control</td>
<td>4.62533*</td>
<td>0.25026</td>
<td>0.000</td>
<td>4.1279-5.1228</td>
</tr>
</tbody>
</table>

Table 5: Intergroup comparisons for the mean and standard deviation values for TNF-α level between CPDM and CP groups after treatment

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>95% Confidence Interval for Mean</th>
<th>F-value</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>7.7267</td>
<td>0.44012</td>
<td>7.5623-7.8910</td>
<td>8.111</td>
<td>0.006</td>
</tr>
<tr>
<td>CPDM</td>
<td>8.2257</td>
<td>0.85280</td>
<td>7.9072-8.5441</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Correlations between the clinical periodontal parameters and TNF level

<table>
<thead>
<tr>
<th>TNF-α</th>
<th>Groups</th>
<th>Statistical analysis</th>
<th>PLI</th>
<th>GI</th>
<th>PPD</th>
<th>RAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>control</td>
<td>r</td>
<td>0.168</td>
<td>0.242</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P-value</td>
<td>0.375</td>
<td>0.198</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>sig</td>
<td>NS</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPDM</td>
<td>r</td>
<td>0.016</td>
<td>0.260</td>
<td>0.198</td>
<td>0.170</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P-value</td>
<td>0.932</td>
<td>0.166</td>
<td>0.295</td>
<td>0.370</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sig</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>CP</td>
<td>r</td>
<td>0.059</td>
<td>0.008</td>
<td>0.267</td>
<td>0.184</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P-value</td>
<td>0.757</td>
<td>0.966</td>
<td>0.154</td>
<td>0.331</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sig</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

Correlation is significant at 0.05 level (2-tailed).

Discussion

Clinical periodontal parameters:

The result of this study revealed highly significant reduction in the plaque index, gingival index, probing Pocket depth, with highly significant gain in relative attachment level between the baseline and after treatment values in both CPDM and CP groups. This may be due to that the process of scaling and root planing leads to disruption of the subgingivally located plaque biofilm, and this will allow shifting in the microbial population to those more commonly associated with health. This vast shifting in the composition of subgingival bacterial flora and removing the bacterial endotoxins subgingivally.
result in tissue healing and an improvement of clinical periodontal parameters can be obtained, as conducted by many studies (20-22). This was in agreement with other studies which suggested that SRP resulted in elimination of bacterial plaque pathogenicity and other contributing factors for periodontal diseases which result in terminating of the periodontal disease progression and returning to health status (23-26).

**TNF-α level:** Highly significant reduction in TNF-α level after treatment were found for both CPDM and CP groups. This finding suggested that a reduction of periodontal inflammation after treatment resulted in the reduction of the inflammatory response, therefore it will result in decrease releasing of pro-inflammatory cytokines including TNF-α. This was in agreement with many studies (14, 27, 28).

Nevertheless, a study by Yamazaki et al. (29) reported that TNF-α were associated with periodontal tissue inflammation but there was no reduction in TNF-α level after treatment. The correlation between the clinical periodontal parameters and TNF-α level showed a non-significant week positive correlation. This were in agreement with other studies (30, 31).

**Conclusions**

Scaling and root planing is an effective process for improvement of clinical periodontal parameters and leads to significantly decreasing in the serum level of TNF-α in type 2 diabetic patients with CP and in systemically healthy patients with CP only. TNF-α may considered as a good immunological marker of periodontal tissue destruction and severity of the inflammation.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding

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Correlation of Glycated Hemoglobin (Hba1c) and Serum Uric Acid in Type-2 Diabetic Patients

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¹Al- Mussaib Technical College, Al-Furat Al-Awsat Technical University, Babylon, Iraq

Abstract

Type -2 diabetes mellitus (DM) is a metabolic disorder identified as chronic hyperglycemia with disturbance of carbohydrate, protein and fat caused by defects in insulin action and/or secretion. This study was designed to determine the relationship between glycated hemoglobin (HbA1c) and serum uric acid (SUA) for type-2 diabetic patients. the study was performed on forty-eight patients (58 ± 14 years old) and thirty-nine healthy individuals matched the sex, and age with patients (control group). Fasting blood samples were collected from both groups. Fasting blood sugar (FBS), SUA concentration, HbA1c level, total protein (TP), cholesterol, and triglyceride (TG) were measured and investigated. The obtained results showed that there is a significant positive correlation (r= +0.103, p= 0.04) between HbA1c and SUA for patients group. As well as significant positive correlations with FBS (r= + 0.410), TG (r= +0.305), TP (r=+0.322), and cholesterol (r=+0.23). Comparison study was also performed between patients and healthy subjects and the results showed a significant elevation for SUA, TG, cholesterol, TP, FSB, and HbA1c for the patients in type-2 diabetes compared with healthy subjects. The current study confirms serum uric acid level acts as a biomarker of blood glucose and has an adverse effect on glycemic control in type-2 diabetic patients.

Keywords: Type-2 diabetes, Serum Uric acid, HbA1c.

Introduction

Diabetes mellitus (DM) considered as a widespread global disease. conferring to recent reports, about 171 million persons in the world with DM in the year 2000 and this number expected to increase to 366 million through 2030 [1,2]. This disease is correlated with reducing life expectancy and significant other illnesses due to its relationship with microvascular complications (ischaemic heart disease, stroke and peripheral vascular disease), as a result led to lessen life quality [3].

Glycated hemoglobin (HbA1c) represents the blood glucose average level within the past 3 months. Therefore, HbA1c is a very important biochemical parameter that provide long term status of blood glucose levels and monitoring tool for measuring glycemic control in Type – 2 diabetic patients [3]. HbA1c in general, developed when the hemoglobin joined with glucose in the blood and become glycated [4]. According to many studies, HbA1c levels could be used as an independent risk factor for stroke and Cardiovascular disease (CVD) in both healthy and diabetics persons. It has been found that a (0.2%) decrease of HbA1c level can lower the risk of CVD development by 10% [5]. Furthermore, many studies have revealed, newborns moms with high HbA1c levels are more likely suffering from development of CVD in the future [6]. Serum uric acid may be considered also as indicator for glycometabolic disorder due to its relationship with metabolism of glucose [7]. It is well known that uric acid is the final breakdown products of purin metabolism [8]. Elevated uric acid concentration can cause a cardiovascular disease [9]. Facchini et al showed when urinary uric acid excretion decrease (which is proportional to increase in insulin resistance) lead to rise in serum uric acid concentration [10]. Different reports have suggested that uric acid might be involved in the atherosclerotic development and its clinical problems. When uric acid concentrations elevated can act as a prooxidant and thus could be an oxidative stress marker, however it might have also worked as an antioxidant

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Based on above information, this study is focused on finding the possibility of any correlation between glycated hemoglobin and serum uric acid, as well as to compare other important biochemical parameters between health and patient groups.

Materials and Method

This study was conducted on 48 patients (22 females and 26 males) diagnosed with type-2 diabetes their age ranged from (38-74) years old (mean of 58 ± 14 years), and 39 healthy individuals (20 females and 19 males) randomly were selected with the same age as type-2 diabetic patients (Control Group). Blood samples were collected from the private clinic in northern Hilla (Babylon province) during the time from June to November 2018. Subjects who had any history of renal, cardiovascular, stroke or any history that may be effect their serum uric acid concentration were excluded. A complete history for each individual was recorded before any clinical test was performed including name, sex, age, duration of diabetes, diet and drugs, weight, and height. About 6 ml fasting venous blood specimens were gathered from both patients and healthy groups. 2 ml were transferred into anticoagulant EDTA container for estimating HbA1c, and the rest were subjected for centrifugation. After that, serum was separated which then used for assess other biochemical parameters. Fasting blood sugar (FBS), HbA1c, Serum uric acid, Triglyceride (Tg), cholesterol (CHO), and total protein (TP) were all measured for both control and patient groups by the enzymatic colorimetric methods using oxidase for FBS, Uricase for serum uric acid, Biuret method for TP, glycerol phosphate oxidase for Tg, and cholesterol oxidase-phenol 4-aminoantipyrine peroxidase for Cholesterol. HbA1c was measured using the instruction guidance of (PARAMEDICAL Kit, Italy).

Statistical Analysis

SPSS version 23.0 was used for data analysis.

Results and Discussions

Glycated HbA1c is commonly used as a clinical indicator for glycemic control. It is an easy assessment of mean level of glucose for the past 2-3 months and it is used as a tool to recognize people with undiagnosed type-2 DM or who are at risk of it. SUA is identified as a possible risk factor for many cardiovascular diseases, hypertension, and stroke. Researcher reported that a 59.5umol, increase in SUA cause in a 60% increase in developing of type-2 DM.

This study was focused on evaluation of HbA1c, serum uric acid levels and other important biochemical aspects for type-2 diabetic patients and comparing their results with healthy individuals (control). Moreover, finding the correlation between HbA1c and serum uric acid, as well as age with all measured parameters. The study was setup up in patients group had mean age 58 ± 14 and healthy individuals (control) age 55 ± 11. Gender and age distribution for both groups were shown in table 1. Other descriptive physical characteristics were presented in table 2. In this study, the distribution of type-2 patients by the gender and HbA1c data demonstrated that most of them undergoing poor glycemic control irrespective to their gender as shown in Table 3.

Based on obtained records there is no significant differences in the weight and IBM for patients and healthy individuals.

Table 1: Gender-wise and Age distribution of patients and control groups

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Patients</th>
<th>Healthy (Controls )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Subjects</td>
<td>48</td>
<td>39</td>
</tr>
<tr>
<td>Age (years) Mean ± SD</td>
<td>58 ± 14</td>
<td>55 ± 11</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>22 (45.8%)</td>
<td>19 (48.7%)</td>
</tr>
<tr>
<td>Female</td>
<td>26 (54.1%)</td>
<td>20 (51.2%)</td>
</tr>
</tbody>
</table>
Table 2: Physical characteristics for patients and control groups

<table>
<thead>
<tr>
<th>Physical characteristics</th>
<th>Patients</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>160.3 ± 22</td>
<td>158 ± 18</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>82 ± 17</td>
<td>79 ± 8</td>
</tr>
<tr>
<td>B.M.I (Kg/m$^2$)</td>
<td>32 ± 1.8</td>
<td>31 ± 4.2</td>
</tr>
</tbody>
</table>

According to the observed outcomes, FBS of patients was 175.5 ± 30.08 (mg/dL) which is significantly higher than control group their mean 74.17 ± 13.76 (mg/dL) (P < 0.01). Concerning to glycated hemoglobin HbA1c, patients with type-2 diabetes had significantly higher mean value 8.852 ± 0.5803 compared to 5.16 ± 0.5049 of control group (P < 0.01). This outcome consists with several studies [16,3,4]. In diabetic patients group, total protein results were shown significantly elevating (6.15 ± 0.98) in comparison to control group (4.31 ± 0.73). This results is an agreement with [17,18]. Elevating in concentration of total protein may be because the elevation of acute phase proteins (like globulins, fibtingen, and compounded) by decrease in the rate of fractional synthetic of albumin due to insulin deficiency or resistance [17]. Similarly, the serum uric acid for diabetic type-2 patients is significantly higher in comparison with healthy group 7.95 ± 0.87 and 5.98 ± 0.715 respectively. This finding is similar to earlier reported studies [19] in which hyperuricemia has been correlated with the greater risk for the development of impaired glucose tolerance and type-2 DM [20]. Cholesterol and TG both showed significantly higher value for diabetic patients (202.75 ± 22.2, 190.63 ± 22.7) comparing to control group (142.67±27.1, 124.67 ± 18.2) respectively which is consists with several studies [2, 21, 22]. Data comparison is showing in Table 3.

Table 3: Different measuring of biochemical parameters in patients and healthy groups.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>(Health) control n=39</th>
<th>(patient) n=48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uric acid mg/dl</td>
<td>5.98 ± 0.715</td>
<td>7.95 ± 0.87</td>
</tr>
<tr>
<td>TG mg/dl</td>
<td>124.67 ± 18.2</td>
<td>190.63 ± 22.7</td>
</tr>
<tr>
<td>Cholesterol mg/dl</td>
<td>142.67 ± 27.1</td>
<td>202.75 ± 18.2</td>
</tr>
<tr>
<td>Total protein mg/dl</td>
<td>4.31 ± 0.73</td>
<td>6.15 ± 0.98</td>
</tr>
<tr>
<td>FSB mg/dl</td>
<td>74.17 ± 13.76</td>
<td>175.5 ± 30.08</td>
</tr>
<tr>
<td>HbA1c%</td>
<td>5.16 ± 0.5049</td>
<td>8.852 ± 0.5803</td>
</tr>
</tbody>
</table>

The correlation of HbA1c with serum uric acid was positive (r = +0.103, p = 0.042) (Table 4) and statically significant. This agree with several reported studies [14,19]. Based on that, the obtained results propose the adverse effect of elevated SUA for glycemic control. Other reporters suggest that there is a possible mechanism for the relationship between elevated SUA and HbA1c in DM patients could be linked to the defect of reabsorption of uric acid in the proximal tubal in diabetic individuals with high glucose levels [19]. Positive correlation statically significant was observed between HbA1c and FBS (r = +0.410, p=0.025). This finding is an agreement with many reported studies [19, 23]. HbA1c also showed strong and direct positive correlation with total protein (r = +0.322, p= 0.01). This hypothesis is consistent with earlier findings [24-26]. Furthermore, HbA1c demonstrated significantly positive correlation with TG, and cholesterol (r = +0.305, p= 0.051), (r = +0.23, p = 0.031) respectively. Several studies have demonstrated a significant positive correlation between HbA1c and lipid profile parameters (triglyceride, and cholesterol) and they proposed the vital rule of glycemic control in normalizing dyslipidemia [23]. correlation data is showing in Table 4. Additional correlation study was made between age of patients and all above biochemical parameters and the results demonstrated no significant correlation between them.

Table 4: Correlation of HbA1c with different biochemical blood parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Correlation coefficient (r)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uric acid</td>
<td>+0.103</td>
<td>0.042</td>
</tr>
<tr>
<td>FBS</td>
<td>+0.410</td>
<td>0.025</td>
</tr>
<tr>
<td>TG</td>
<td>+0.305</td>
<td>0.051</td>
</tr>
<tr>
<td>Total protein</td>
<td>+0.322</td>
<td>0.01</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>+0.23</td>
<td>0.031</td>
</tr>
</tbody>
</table>

NS, Non-significant

Further comparison investigation was done between male and female diabetic patients; the results indicates no significant differences except for SUA and HbA1c, where uric acid is significantly higher in female compared with male for patients in type-2 DM, while for HbA1c the result showed that the male patients had significantly higher level compared with female patients as shown in table 5.
Table 5: (Patient) male vs female

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Male n = 22</th>
<th>Female n= 26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uric acid mg/dl</td>
<td>6.25 ± 0.97</td>
<td>8.67 ± 1.36</td>
</tr>
<tr>
<td>TG mg/dl</td>
<td>192.63 ± 22.7</td>
<td>189.00 ± 34.76</td>
</tr>
<tr>
<td>Cholesterol mg/dL</td>
<td>202.75 ± 22.2</td>
<td>189.83 ± 21.22</td>
</tr>
<tr>
<td>Total protein mg/dl</td>
<td>6.25 ± 0.98</td>
<td>5.93 ± 1.506</td>
</tr>
<tr>
<td>GLU</td>
<td>188.5 ± 23.08</td>
<td>159.19± 18.23</td>
</tr>
<tr>
<td>HbA1c</td>
<td>8.852 ± 0.5803</td>
<td>7.18 ± 1.01</td>
</tr>
</tbody>
</table>

P ≤ 0.05

**Conclusion**

SUA has an adverse impact on glycemic control since there is a positive correlation with HbA1c. In addition, SUA concentrations significantly higher in type-2 DM patients in compassion with healthy subjects.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors have no conflict of interest.

**Funding:** Self-funding

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Detection of Amplified Her2 / Neu Gene Score 2 Cases in Breast Cancer Using Chromogenic In Situ Hybridization

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Abstract

Both Her2 gene and Her2 protein are part of normal cell growth they seen in the breast cells of people without cancer, but sometime mistakes in a cell DNA and mutation cause the body to create many HER2 proteins. For diagnosis of HER-2/neu gene amplification, A total of 60 paraffin embedded breast tumors block from women with final histopathology diagnosis of invasive ductal breast carcinoma. All these samples were chosen as scored 2+ (equivocal) Her-2/neu by using Immunohistochemistry (IHC) technique. CISH as molecular method to detect Her-2/neu gene amplification was used. The high number and percentage (33/55%) of the breast cancer cases were found in pre-menopause Group < 50 years old. The highest number of the breast cancer cases grade II was most common (42/70%). There were significant differences between age groups and between all histological grades. Stage IIIA was the highest one (25/41.7%) with significant differences between all stages. Using chromogenic in situ hybridization methods to detect HER2/neu gene the amplified cases were (36.6%). There were high significant differences between age, tumor grade and stage within amplified cases. CISH is hopeful to detect gene expression when the HER2/neu is score 2 (equivocal). It is valuable and considerable when correlated its results with the age, tumor grade and stage.

Keywords: HER2 / neu gene, Cancer, In Situ hybridization

Introduction

The her2 gene makes her2 proteins which act as human epidermal growth factor receptor (ERBB family), both live on the outer of the breast cells and get singles from the body, these signals can notify cells to repair damage, grow and multiply. Both Her2 gene and Her2 protein are part of normal cell growth they seen in the breast cells of people without cancer, but sometime mistakes in a cell DNA and mutation cause the body to create many HER2 proteins, this lead to breast cells grow faster causing breast cancer. HER2 proteins expression have been made known to form clusters in cell membranes and over-expression Her2 may play important role in tumorigenesis and progression.

Amplification of the ERBB2 gene, occurs in about 15-30 percentage of breast cancers also It is strongly related with increased recurrence and a poor prognosis. All these signaling pathways including mitogen-activated protein kinase (MAPK), protein kinase C (PKC), phosphoinositide 3-kinase (PI3K/Akt) and Signal transducer and activator of transcription (STAT) activated by Her2 gene. Signaling through the ERBB family of receptors induces cell proliferation and opposes apoptosis, thus must be strongly regulated to evade uncontrolled cell growth.

There are many HER2 tests were used to quantify and determine if patients will respond to certain medications for HER2-positive breast cancers. Chromogenic in situ hybridization (CISH) is a cytogenetic technique that combines the chromogenic signal detection method of immunohistochemistry (IHC) techniques with in situ hybridization.
In invasive breast cancer, HER2/neu status diagnosed as negative, equivocal, or positive. HER2 status consider positive when the examining an area of tumor that amounts more than 10% of homogeneous and contiguous tumor cells that is indicate protein over expression by IHC. If results are equivocal by IHC (Weak to moderate complete membrane immune reactivity in more than 10% of the tumor cells or intense circumferential membrane staining in less than 30% cells), reaction testing should be performed using the another assay like CISH \cite{14, 15}. Aim of this study is detection of HER2/neu gene expression by evaluation of amplified cases within score 2 which are given the idea about target therapy via CISH molecular method.

**Materials and Method**

**Patients**

Total of 60 paraffin embedded breast tumors block from women with final histopathology diagnosis of invasive ductal breast carcinoma. The mean age ranged between 34-75yr. All these samples were chosen as scored 2+ (equivocal) Her-2/neu by using Immunohistochemistry (IHC) technique. The same tissue blocks used for CISH as molecular method to detect Her-2/neu gene amplification using FDA approved Path-Vysion Her-2/neu/CEP 17 dual color probe. IHC and CISH were established by two pathologists using typical light-microscopic.

**Histopathology Processing**

CISH method was done according to manufacturer’s instructions, 4μm sections from paraffin embedded human tissue mounted on charged slid was submission in automated VENTANA SYSTEM /Roche which the run take 16 hr after deparaffinized.

**Slides Examination**

Examination method for gene amplification within tissues depended on dotes in nucleus of tumor cells including two colors. RED dotes represents Chrom17 and BLACK represents amplified gene. Intensity of Dotes must be clear, well balanced, distinct and easy to evaluate. Normal cells in the sample used as an internal control for the staining, normal cells should have 1-2 clearly visible blue dotes and 1-2 clearly visible red dots. Results should be considered invalid if the dotes in normal cells will failure to detect. Numeric estimation of normal cells should give a result related to expected value for normal diploid cells.

Account method of amplified gene dotes

Selected distinct tumor areas for assessment and exam the slide to account for possible heterogeneity. Counted signals in each cell nucleus by 40X power field of light microscope. The Black and Red dote were count in 20 nuclei in tumor areas. In case of cell’s nucleus have cluster red dote count 21 cells, In case of cell’s nucleus have cluster black dotes then count 12 cells. The ratio by dividing total no. of Black dotes by the total no. of Red dotes should be at or near the cut-off (1.8-2.2). If the ratio of examined 20 cells under “2” consider non Amplified Her-2/neu gene, If the ratio of 20 cells over “2” consider Amplified.

**Statistics**

The Statistical Analysis System- SAS (2012) program was used. The $\chi^2$ test was used to compare between percentage of Age, grade and stages and their correlated with amplified and non-amplified Her-2/neu gene in score 2 cases. $P < 0.05$ was considered statistically significant \cite{16}.

**Results**

**Clinicopathological parameters of Breast Cancer patients**

Out of sixty samples were randomly selected for the study, The high number and percentage (33/55%) of the breast cancer cases were found in pre-menopause group < 50 years old while it was 27/45% in menopausal group (≥ 50 years old) with P-value 0.0422* , Figure 1. According to the Figure (2), the breast cancer cases grade 2 was the highest number and percentage 42/70%, while grade 1 was the less one (4/6.6%). There are significant differences between age groups and between all histological grade with P-value 0.0422* and 0.0001** respectively. Different percentages of stages distribution appeared in Figure 3, stage IIA was the highest one (25/ 41.7%) versus stage IIIB (1/1.7%) with significant differences between all stages ( P-value 0.0001 **).
HER2/neu gene amplification in score 2 samples

Figure 4 showed the HER2/neu gene amplification status with score 2 cases using CISH assay. The results detected significant differences between high number & percentage (38/63.3%) of not amplified (negative signal) cancer cases, Figure 5 (A, B), and (22/36.7%) of amplified (positive signal) cancer cases of the total studied patients, Figure 6(C,D).

Correlation of amplified HER2/neu gene cases with age, grade and stage

HER2/neu gene score 2 positive amplified was high with significant differences 0.0001 ** in women age less than 50 (72.7%) versus in age more than or equal 50 (27.3%). However, the high percentage of non-amplified cases in different ages was predominant. According to new data the HER2/neu gene score 2 was positive amplified in grade II (45.5%) and grade III (45.5%) compared to grade I (9.1) with P-value 0.0001**, Table 1. Stages IIIA and IIC were high percentage in amplified cases (50%, 22.7%) respectively compared to non-amplified cases (36.1%,9.1%) respectively with significant difference (P-value 0.0261 *,0.0382 *), generally there were high significant differences between
all stages within amplified and non-amplified HER2/neu gene cases (P-value \(0.0001\) **), Table 1.

**Table 1:** HER2/neu gene score 2 cases associated with age, grade and stage of breast cancer using Chromogenic in situ hybridization

<table>
<thead>
<tr>
<th>Parameters</th>
<th>HER2/neu gene Amplified</th>
<th>HER2/neu gene Non amplified</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;50</td>
<td>6(27.3%)</td>
<td>21(55.3)</td>
<td>0.0004 **</td>
</tr>
<tr>
<td>≤ 50</td>
<td>16(72.7%)</td>
<td>17(44.7)</td>
<td>0.0004 **</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>38</td>
<td>---</td>
</tr>
<tr>
<td>P-value</td>
<td>(0.0001) **</td>
<td>(0.077) NS</td>
<td>---</td>
</tr>
</tbody>
</table>

Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>HER2/neu gene Amplified</th>
<th>HER2/neu gene Non amplified</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2(9.1%)</td>
<td>2(5.3)</td>
<td>0.0849 NS</td>
</tr>
<tr>
<td>II</td>
<td>10(45.5%)</td>
<td>32(84.2)</td>
<td>0.0073 **</td>
</tr>
<tr>
<td>III</td>
<td>10(45.5%)</td>
<td>4(10.5)</td>
<td>0.0081 **</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>(0.0001) **</td>
<td>(0.0001) **</td>
<td></td>
</tr>
</tbody>
</table>

Stage

<table>
<thead>
<tr>
<th>Stage</th>
<th>HER2/neu gene Amplified</th>
<th>HER2/neu gene Non amplified</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>0(0.0)</td>
<td>3(7.9)</td>
<td>0.0497 *</td>
</tr>
<tr>
<td>ПIA</td>
<td>1(4.5)</td>
<td>5(13.2)</td>
<td>0.0433 *</td>
</tr>
<tr>
<td>ПIIA</td>
<td>11(50)</td>
<td>14(36.8)</td>
<td>0.0261 *</td>
</tr>
<tr>
<td>ППВ</td>
<td>2(9.1)</td>
<td>9(23.7)</td>
<td>0.0316 *</td>
</tr>
<tr>
<td>ППВ</td>
<td>1(4.5)</td>
<td>0(0.0)</td>
<td></td>
</tr>
<tr>
<td>ППС</td>
<td>5(22.7)</td>
<td>2(9.1)</td>
<td>0.0382 *</td>
</tr>
<tr>
<td>Negative</td>
<td>2(9.1)</td>
<td>5(13.2)</td>
<td>0.0832 NS</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>38</td>
<td>---</td>
</tr>
<tr>
<td>P-value</td>
<td>(0.0001) **</td>
<td>(0.0001) **</td>
<td>---</td>
</tr>
</tbody>
</table>

*)P<0.05, **)P<0.01.

**Discussion**

Study results revealed that breast cancer risk exist at any age but it was increased at the middle age of women’s life (Fig 1). Many studies go in line with results of current study, one of them in India and other Asian countries reported 48% were premenopausal and 52% in menopause patients suffering from breast cancer [17]. Risk increases by about 3% for each year older at menopause period [18].
In general, risk of breast cancer increased in pre- and post-menopausal patients who had early onset of menarche and delayed menopause maybe caused by the increase in the duration of hormonal exposure [19]. Two studies confirmed that breast cancer is occur in older women and the incidence of this disease increases with the age plus it is rare below the age of twenty years [20]. According to the American Cancer Society, about 1 out of 8 invasive breast cancers develop in women younger than 45. About 2 out of 3 invasive breast cancers are found in women 55 or older [21].

Risk factors related to lifestyle, are not having pregnancy history or pregnancy at older ages, using of birth control pills, using hormone therapy after menopause, not breast-feeding, alcohol, obese, lack of exercise, and induced abortion [22].

According to American grade the grade I (well differentiated), II (moderately differentiated), III (poorly differentiated). In general, the American Cancer Society (2003) reported that that histological grade is a sign of aggressive tumors and may be consider an important factor in different race. Socioeconomic factors, treatment differences and late-stage presentation have been proposed as main causes of difference [23]. Recent data (Fig 2) showed that grade 2 (70%) and grade 3 (23.3%) the high prevalence in breast cancer samples compared with grade 1 (6.6%), these results go in line with Madrid and Lo result [11].

According to Fig 4 amplification of HER-2 was 22/36.6% compared to non-amplified cases 38/63.3% which agreement with many studies. HER-2/neu, a proto-oncogene, has been found in several types of cancers, commonly in breast cancer [24]. The amplification of HER-2 is about 25–30% of the breast cancers in the population [25], these data agreement with current study. Rosa, et al. (2013) cited that cases scored as 2+ by using IHC showed amplification by CISH in approximately 34% of tumors cases [26]. Studies hypothesized that the more aggressive breast cancer might be due to a higher incidence of HER-2 gene amplification [27].

Correlation between ages, grades and stages in this study (Tab 1) different from Zhao et al. (2002), by using CISH assay, they found that (36.25%) cases were positive Her2/neu gene amplification. Age ≥ 50 was amplified in (46.55%) cases, while Age <50 was amplified in (53.44%) cases. Cancer Grade 2 score 2 and 3 showed high percentage of amplification (70.59%), (60.98) respectively compared to grade 3 score 2 and 3 which was (29.41), (39.02) respectively [27].

Conclusion

It has successfully evaluated Her2/neu gene amplification using CISH in automated VENTANA system as a molecular method .CISH is hopeful to detect gene expression when the HER2/neu is score 2(equivocal). It be valuable and considerable when correlated its results with the age , tumor grade and stage.

Acknowledgment: The authors would like to thank Al-Mustansiriyah University (www.uomustansiriyah.edu.iq) Baghdad, Iraq for its support in the present work and special thanks to Oncology Teaching Hospital for their help in providing all information for this study.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors have no conflict of interest.

Funding: Self-funding

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Interleukin-12A (Rs583911) Polymorphism in Pediatric Patients with Acute Lymphoblastic Leukemia In Iraq

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¹Department of Medical Microbiology, College of Medicine, Al-Qadisiya University, Diwaniyah, Iraq

Abstract

Acute Lymphoblastic Leukemia is a malignant disorder of lymphoid progenitor cells and the most common type of malignant neoplasms in children.

This study was conducted to evaluate the role of IL-12A (rs583911) gene polymorphism in the pediatric acute lymphoblastic leukemia.

Evaluated and investigated the single nucleotide polymorphisms of IL-12A (rs583911) gene in 120 subjects. Sixty were Acute Lymphoblastic Leukemia patients while others were apparently healthy individuals used as a controls.

The frequencies of genotype AA was significantly more frequent in study group than in control groups, 26.7 % versus 10.0 %, variant allele A was more frequent in study than in control group, 43.35% versus 56.7 %.

AA genotype is mainly expressed among Acute Lymphoblastic Leukemia patients and it may considered as a risk factor for ALL.

Keywords: Acute Lymphoblastic Leukemia, IL-12A (rs583911), Allele, Genotype, AS-PCR.

Introduction

Acute lymphoblastic leukemia (ALL) is a malignant disorder of lymphoid progenitor cells and the most common type of malignant neoplasms in children¹⁰. Both T-cell and B-cell precursors can give rise to ALL; B-cell ALL represents about 88% of all cases¹⁰.

Its incidence peaks between the ages of 2 and 5 years; rates are lower during later childhood, adolescence and young adulthood. It is the most common leukemia in children representing 23% of cancer diagnosis among children younger than 15 years³. The incidence of the disease is higher in boys than in girls (four times for T-cell ALL), except that girls have a higher (1.5 times) incidence of leukemia in the first year of life⁴. The most low rates are found in developing countries, among US blacks, Israeli Jews, and Chinese and Asian Indians, whose rates may be many times lower than those in more affluent developed countries⁹.

The pathogenesis of ALL can be related to different environmental and genetic factors: Environmental factors, such as ionizing radiation, electromagnetic field, certain diets (e.g., bioflavonoids), seem to have little association in most of the ALL cases⁶. However, two infection-based hypotheses, Greaves’ “delayed infection” hypothesis and Kinlen’s “population-mixing” hypothesis that childhood ALL arise as a consequence of an abnormal immune response in susceptible individuals to common infections, are well supported by epidemiological data⁷,⁸, while the genetic factors play an important role in the etiology of ALL and this arise from in utero chromosomal abnormalities that can lead to clonal expansion of pre-leukemic precursor cells⁹. Cytokines are small molecules secreted by cells in response to specific stimuli and alter the behavior of the same or other cells. Cytokines act on target cells generally within the hematopoieticsystem by binding to specific receptors, initiating signal transduction.

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and second messenger pathways within the target cell. Production of numerous cytokines by immune cells in response to both antigenspecific and non-specific stimuli is critical to the outcome of inflammatory immune responses. Many single-nucleotide polymorphisms (SNPs) were detected within cytokine gene sequences, several of these polymorphisms may be associated with differential levels of gene transcription, genetic studies have tried to correlate these cytokine polymorphisms with immune-mediated diseases. For example, associations were reported between SNPs in the TNFA promoter and rheumatoid arthritis. A number of studies reported associations between TNFA or LTA SNPs and particular cancers, including chronic lymphocytic leukemia.

Interleukin-12 (IL-12) is a pro-inflammatory cytokine that is mainly secreted by antigen-presenting cells, targets T-helper (Th) cells and natural killer cells, and stimulates the synthesis and secretion of interferon gamma (IFN-γ), which is a well-established anti-tumor factor. Also, there have been observed the lower serum IL-12 levels in patients with various types of cancer, this suggesting that IL-12 functions as a potent tumor suppressive factor. Biologically active IL-12 consists of two functional subunits, p35 and p40, which are encoded by the IL-12A and IL-12B genes, respectively. The tumor-suppressive effect of IL-12 is well documented, thus, functional polymorphisms of the IL-12A and IL-12B genes are thought to be good genetic candidates for cancer susceptibility. Extensive studies have explored the potential associations of IL-12A and IL-12B genetic variants with cancer risk. The present study was conducted to evaluate the role of IL-12A (rs583911) gene polymorphism in the Acute lymphoblastic leukemia.

**Materials and Method**

**Patients**

This study was conducted on 60 patients (40 male and 20 female) attended to Central Child Teaching Hospital in Baghdad, Iraq, for the period from first of February 2018 to the first of June 2018, the patients were diagnosed as acute lymphoblastic leukemia by hematology and pediatric consultant in the oncology unit in the hospital. Patients were interviewed directly by using an anonymous questionnaire form which covered age, sex, family history of any malignant disease and others. Another group consists of 60 apparently healthy individuals (42 male and 18 female) without any history of malignant disease were clinically considered as healthy also included in this study as a control group. Informed consent was obtained from all study subjects after explanation of the nature and possible consequences of the study.

**Genotyping**

The genotypes of the IL-12A (rs583911) gene were determined by Allele Specific-PCR, Table (1). The PCR products were amplified using a Maxime PCR PreMix (iNtRON), then the PCR products were visualized in an ethidium bromide-stained 2% agarose gel using a UV Transilluminator.

<table>
<thead>
<tr>
<th>Primers</th>
<th>Sequence (5'-3')</th>
<th>Amplicon</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL12-Agene</td>
<td>Wild type R</td>
<td>CGTTGGATGAGCTTGTCCTT AAGGGTTTGC 100bp wild type allele (A)</td>
</tr>
<tr>
<td></td>
<td>Mutant type R</td>
<td>ACGTTGGATGCAAGTATAACT TCTAAAGGG 50 bp Mutant type allele (G)</td>
</tr>
<tr>
<td>rs583911Allele Common Forward Primer</td>
<td>TTTGCATGTTTGTATATCCATCA</td>
<td></td>
</tr>
</tbody>
</table>
Statistical Analysis

The Hardy–Weinberg equilibrium (HWE) assumption was assessed for both the patient and control groups by comparing the observed numbers of each genotype with those expected under the HWE for the estimated allele frequency. Data were presented, summarized, and analyzed using two software programs. These were the Statistical Package for Social Science (SPSS) version 20 and Microsoft Office Excel 2010. Logistic regression analysis was used to estimate the odds ratios (OR) and 95% confidence intervals (CI) for the association between the genotypes, alleles or haplotypes and the risk of ALL. The results are presented as the mean values ± 1 standard deviation (SD), and a P value of ≤0.05 was considered to indicate statistical significance.

Results and Discussion

Demographic and clinical parameters

Patients with ALL were comparable in age, gender and family history of any malignant disease with controls (Tables 2, 3, and 4).

Table 2: The Patient-Control Difference in mean age.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Control group n = 60</th>
<th>Study group n = 60</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ±SD</td>
<td>5.64 ±3.20</td>
<td>6.13 ±3.00</td>
<td>0.164 NS</td>
</tr>
<tr>
<td>Range</td>
<td>2-12</td>
<td>2-14</td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>4.50 (5.00)</td>
<td>5.5 (4.00)</td>
<td></td>
</tr>
</tbody>
</table>

SD: standard deviation; n: number of cases; *: Mann Whitney U test; NS: not significant at P ≤ 0.05

Table 3: Comparison of Gender Frequency Distribution Between Control and Patient Groups.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Control group n = 60</th>
<th>Study group n = 60</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n (%)</td>
<td>42 (70.0%)</td>
<td>40 (66.7%)</td>
<td>0.695 NS</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>18 (30.0%)</td>
<td>20 (33.3%)</td>
<td></td>
</tr>
</tbody>
</table>

n: number of cases; *: Chi-square test; NS: not significant at P ≤ 0.05

Table 4: Association Between Disease and family history of any malignancy disease

<table>
<thead>
<tr>
<th>Family history</th>
<th>Control group n = 60</th>
<th>Study group n = 60</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive, n (%)</td>
<td>0 (0.0%)</td>
<td>34 (56.7%)</td>
<td>&lt; 0.001 HS</td>
</tr>
<tr>
<td>Negative, n (%)</td>
<td>60 (100.0%)</td>
<td>26 (43.3%)</td>
<td></td>
</tr>
</tbody>
</table>

n: number of cases; *: Chi-square test; HS: highly significant at P ≤ 0.01

Distribution of IL12-A rs583911 Genotypes AA, AG and GG in Control and Study Groups

Distribution of IL-12A rs583911 polymorphism was detected by AS-PCR technique, at this locus there’re three genotype GG, GA and AA figure (1).

Figure 1: Agarose gel electrophoresis image that showed the AS-PCR product analysis of IL12-A rs583911 (A/G) at 2% agarose. Where M: marker (2000-100bp), Lane (1, 4, 5, 7, and 10) as (A/G) heterozygote genotypes, and lane (2, 3, 8 and 9) as (AA) wild type homozygote genotypes, and lane (6) as (GG) mutant type homozygote genotypes. A allele product at 100bp and G allele product at 55bp AS-PCR product size.
The current study revealed that the most prevalent IL12-A rs583911 genotype was AA so it considered the wild type (reference) whereas the least frequent IL12-A rs583911 genotype was GG, therefore it regarded as the variant (mutant) genotype. Considering control group, the frequency distribution of IL12-A rs583911 genotype AA, AG and GG were 16, 30 and 14, respectively and this observed distribution did not differ significantly from the expected distribution according to Hardy Weinberg equation ($P = 0.444$), as shown in table (5).

### Table 5: Hardy Weinberg equilibrium of IL12-A rs583911 genotype in control group.

<table>
<thead>
<tr>
<th>Genotypes</th>
<th>Observed</th>
<th>Expected</th>
<th>$\chi^2$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA (wild)</td>
<td>16</td>
<td>25.4</td>
<td>0.587</td>
<td>0.444 NS</td>
</tr>
<tr>
<td>AG</td>
<td>30</td>
<td>27.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GG (mutant)</td>
<td>14</td>
<td>7.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NS: not significant at $P \leq 0.05$

Considering study group, the frequency distribution of IL12-A rs583911 genotype AA, AG and GG were 6, 20 and 34, respectively and this observed distribution differed significantly from the expected distribution according to Hardy Weinberg equation ($P = 0.001$), as shown in table (6).

### Table 6: Comparison of IL12-A rs583911 genotype between control and study groups

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Control group $n = 60$</th>
<th>Study group $n = 60$</th>
<th>$\chi^2$</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>16 (26.7 %)</td>
<td>6 (10.0 %)</td>
<td>14.879</td>
<td>0.001 HS</td>
</tr>
<tr>
<td>AG</td>
<td>30 (50.0 %)</td>
<td>20 (33.3 %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GG</td>
<td>14 (23.3 %)</td>
<td>34 (56.7 %)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$n$: number of cases; *: Chi-square test; HS: Highly significant at $P \leq 0.01$

A study by Chang et al., (2010) of 208 SNPs, only rs583911 of IL12A, which encodes a critical modulator of T-cell development, remained significant after accounting for multiple testing (odds ratio for each copy of the variant G allele = 1.52, 95% confidence interval: 1.25–1.85, $p = 2.9 \times 10^{-5}$) (15). This result supports our finding that allelic variation exists in the gene encoding IL-12A in children with ALL; and agree that the variant allele G may considered as a risk factor for ALL in children.

Previous studies have shown that newborns have Th2-skewed immune profiles (16). Furthermore, during the normal course of immune development, a shift from Th2-dominant to Th1-dominant immune profiles occurs with increasing age (17). It is thought that the major driving force for this immune shift is the production of IL-12 by innate immune cells (e.g. dendritic cells) after exposure to microbial challenges (18). The IL-12 protein is a heterodimer that consists of two subunits, IL-12A (p35) and IL12B (p40) (19). In the current study, we observed significant variation with rs583911 of IL-12A. Functional impact of the IL-12A SNPs has yet to be characterized. A study by Pistiner et al. showed that rs2243123 of IL-12A, a SNP in intron 2 that is 739 base pairs away from rs583911, is associated with immune sensitization to cockroach antigen (20); this lends further support that the region around rs583911 may be important in either the function or the expression of IL12A and may be a promising candidate region to perform fine mapping and functional studies to determine causal variants.

### Conclusion

There was an association between IL-12A rs583911 polymorphism in the pathogenesis of pediatric ALL in Iraq. The variant allele G is considered as risk factor for...
acute lymphoblastic leukemia.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors have no conflict of interest.

**Funding:** Self-funding

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Detection of EML4-ALK Fusion Gene Rearrangement in Non-Small Cell Lung Carcinoma in a Sample of Iraqi Patients: A Comparison of Chromogenic in Situ Hybridization with Correlation of ALK Protein Expression

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Abstract

Background: Lung cancer is a major public health problem. It is the most common cause of cancer-related death in men and the second most common in women. Moreover, EML4-ALK (the echinoderm microtubule-associated protein like 4-anaplastic lymphoma kinase fusion gene) has been identified as a potent oncogenic driver in non-small-cell lung carcinoma (NSCLC), in particular adenocarcinoma (ADC) and less commonly squamous cell carcinoma. The aim of current of study was to investigate ALK protein overexpression and its correlation with EML4-ALK gene rearrangement by CISH.

Method: The paraffin embedded blocks were retrospectively collected from 80 patients diagnosed with NSCLC. ALK protein study was performed by using Monoclonal Mouse Anti-Human for IHC and for EML4-ALK fusion gene by using CISH (CISH working solution /Zytovision, Germany).

Results: ALK protein overexpression was detected in (10%, n= 8/80) of NSCLC and the ALK gene rearrangement was (7.5%, n= 6/80). There was high concordance in the assessment of ALK gene rearrangement by CISH techniques and ALK protein expression by IHC (P= 0, r= 0.94).

Conclusion: IHC and CISH were very well correlated in detection of ALK protein expression and ALK gene rearrangement, respectively. Also, CISH is a new and highly practical method to detect EML4-ALK, therefore, it could be introduced in plans of ADC management and less commonly SCC of the lung.

Keywords: Lung cancer, EML4-ALK, NSCLC, IHC, CISH, ALK, TNM.

Introduction

Lung cancer is a major public health problem. It is the most common cause of cancer-related death in men and the second most common in women (1,2). In Iraq, according to the Iraqi cancer registry 2010, lung cancer occupied the second out of ten common cancers, there were 1812 new cases recorded. It is classified as the first famous cancer in males (1380 cases with a percentage of 14.76%) and seventh famous type of cancer in females (432 cases with a percentage of 3.95%) (3). In the United States, it was found that it is the second most frequently diagnosed cancer in males (14%) and it was the second most diagnosed type of cancer in females 13%, black men and women have a higher incidence than white population(4).

Non-small cell lung carcinomas (NSCLC) which represents 85% of all lung tumors, histologically is divided into ADC, SCC and LCC. Most cases occur in older people at age of 65 years. NSCLC has been developed following genetic damage to DNA and epigenetic changes, these changes affect cell proliferation and DNA repair (5). Tobacco smoking is the most important etiological risk factor, other risk factor may include radon and air pollution (6,7).

ALK is a tyrosine kinase receptor and its fusion with the EML4 gene was recently identified in NSCLC (8) almost in 4–6% in non-smokers of lung ADC, this type of mutation rarely occurs in combination with K-RAS.
while it was firstly identified in ALCL resulting in NPM-ALK fusion protein at site t(2;5) (p23;q35). The ALK-signaling pathway includes several biologically important pathways involving cell proliferation, differentiation and anti-apoptosis \(^{11,12}\).

The ALK gene is normally expressed only in the nervous system \(^{13}\). The human ALK gene encodes a 176 kDa protein, the ALK receptor is a single pass transmembrane protein \(^{14}\).

The ligands of ALK are Midkine (MK) and pleiotrophin (PTN) which are growth factors, these ligands are highly expressed in some cancers acting as angiogenic factors that have a role in invasion and metastasis and it stimulates ALK phosphorylation and activates PI3K. The ALK receptor induces activation of signal transduction pathways such as Ras/ERK, JAK/STAT and PI3K/AKT \(^{13}\).

The EML4-ALK fusion oncogene arises from an inversion on the short arm of chromosome 2 (Inv(2) (p21p23)). EML4-ALK contains an N-terminus derived from EML4 and a C-terminus containing the entire intracellular tyrosine kinase domain of ALK \(^{15,16}\). This inversion leads to an increased distance between the red orange and green probes. A deletion of the proximal part combined with the inversion explains the single red signal, these changes can be seen in CISH technique \(^{17}\). There are multiple variants of EML4-ALK have been reported \(^{18,19}\).

**Materials and Method**

**Samples**

Eighty patients with NSCLC (45 men and 35 women) were retrospectively recruited, the tumors were classified into 40 ADC and 40 SCC, patients ages ranged from 34 -80 years. NSCLC cases had been graded into well, moderately and poorly differentiated as 15, 25 and 40 cases, respectively \(^{20}\). In addition, according to TNM classification \(^{21}\) the cases were classified into stages T1, T2, T3 and T4 as 10, 25, 37 and 8 cases, respectively. This study was carried out during the period from December 2015 to March 2017 in the College of Medicine/ University of Kufa, Iraq.

**IHC of ALK in NSCLC tissues**

The envision system was used using primary antibody ALK (Monoclonal Mouse Anti-Human ALK protein, Dako Denmark A/S), positive control used brain tissue (Figure 1) and the staining kit \(^{22}\). Grading scale ranging from 0 to 3 was used for this assessment, where 0 is negative staining, 1 is weak faint cytoplasmic staining, 2 is moderate smooth cytoplasmic staining and 3 is strong cytoplasmic staining in \(\geq 10\)% of tumor cells.

**EML4-ALK Break-Apart Dual-Color CISH**

The ZytoDot ® 2C SPEC ALK Break Apart Probe is a mixture of a Digoxigenin-labeled probe and a Dinitrophenyl labeled probe hybridizing to the 2p23 band \(^{23}\). The formalin fixed paraffin blocks of NSCLC tissue from the same patients were used for detection of EML4-ALK fusion gene, the procedure was done according to manufacturer’s instructions (Zytovision / Germany).

**Scoring and Pattern of ALK Break-Apart Dual-Color CISH**

In each section, one hundred cells were counted. The close approximately of the red and green signals of the intact ALK gene was regarded as negative for ALK gene rearrangement. Another pattern of negative signals was considered when there was an overlap between color signals giving a brown one.

The positive ALK rearrangement was diagnosed when the distance between the green and red signals exceeded the size of one signal. The pattern of positive signals included 2 types:

- **Pattern -1** there were 2 red and 2 green signals.
- **Pattern -2** there was only one red and one green signals together with a brown signal.

**Statistical analyses**

Statistical analyses of all results were carried out using SPSS software statistical package (version 21) using chi squared (P value at a level of significance \(<0.05\)) and correlation test (R at a significant level of 0.3).

**Results**

**ALK protein overexpression**

ALK overexpressions were noted in 10% (8/80 cases) of NSCLC cases. Approximately 2.5% (n= 1) of patients with SCC of the lung showed positive
overexpression of ALK protein, whereas 97.5% (n= 39) negative expression (Figure 4). Similarly, 17.5% (n= 7) of patients with ADC of the lung showed positive overexpression of ALK, whereas 82.5% (n= 33) exhibited negative expression and there was significant difference between the histological types in relation to ALK protein (P= 0.001).

Clinical and pathological correlations of ALK expressions

Table (1) showed that 17.5% (7/40) of patients with ADC had high expression of ALK protein (Figures 2 and 3) when compared with those with only one case of SCC of the lung showing expression of ALK protein with significant difference between the types of NSCLC in relation to ALK protein, but it was more in ADC than SCC (P= 0.001). No significant correlation was observed between ALK protein expressions and the grade of tumor. In addition, there was significant correlation between ALK overexpression and the size (T) of the tumor, higher ALK overexpression was among patients with T3 (16.21%) than T1 or T2 (10% & 4%; P= 0.03).

EML4- ALK genetic translocation

Table (2) showed that EML4-ALK fusion gene was noted in 7.5% (6/ 80 cases) of NSCLC. Approximately 2.5% (n= 1) of patients with SCC showed positive detection rate by CISH (Figure 7), whereas 97.5% (n= 39) of the cases exhibited negative EML4-ALK (Figure 5). Similarly, 12.5% (n= 5) of patients with ADC of the lung showed positive EML4-ALK (Figure 7), whereas 87.5% (n= 35) exhibited negative EML4-ALK by CISH (Figure 6 and 7). The ALK CISH-positive showed a split pattern (Figure 8) which is the most common pattern, whereas IRS pattern (Figure 7).

Clinical and pathological correlations of ALK - EML4 genetic translocation

Table (2) showed that 12.5% (5/40) of patients were with ADC and there was 2.5% (1/40) of SCC of the lung had positive results by CISH. So, there was significant difference between ADC and SCC (P= 0.01). There was high detection rate of EML4-ALK genetic translocation with poorly differentiated NSCLC compared to patients with moderately differentiated NSCLC (12.5%; P= 0.045). In addition, according to the size (T) of the tumor, the most positive cases were frequently distinguished among patients with T3 (13.51%; P= 0.707).

The correlation between IHC expression of ALK and CISH results

Table (3) showed that (1/40 ) of SCC overexpressed ALK protein by IHC and ALK CISH, 5/40 cases of ADC showed positive ALK overexpression and ALK CISH, while 2/40 of ADC showed positive ALK overexpression, but no EML4-ALK by CISH. There was significant correlation between the IHC expression of ALK and the CISH results regarding the type of the tumor (P= 0, r= 0.94).

Table (1) ALK immuno-staining in relation to type of tissue, grade and stage of NSCLC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumor type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADC</td>
<td>7 (17.5%)</td>
<td>33 (82.5%)</td>
<td>40(50%)</td>
<td>P= 0.001</td>
</tr>
<tr>
<td>SCC</td>
<td>1 (2.5%)</td>
<td>39 (97.5%)</td>
<td>40(50%)</td>
<td></td>
</tr>
<tr>
<td>Tumor Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade I</td>
<td>0</td>
<td>15(100%)</td>
<td>15(18.75%)</td>
<td>P= 0.767</td>
</tr>
<tr>
<td>Grade II</td>
<td>2(8%)</td>
<td>23(92%)</td>
<td>25(31.25%)</td>
<td></td>
</tr>
<tr>
<td>Grade III</td>
<td>6(15%)</td>
<td>34(85%)</td>
<td>40(50%)</td>
<td></td>
</tr>
<tr>
<td>Tumor size (T)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>1(10%)</td>
<td>9(90%)</td>
<td>10(12.5%)</td>
<td>P= 0.03</td>
</tr>
<tr>
<td>T2</td>
<td>1(4%)</td>
<td>24(96%)</td>
<td>25(31.25%)</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>6(16.21%)</td>
<td>31(83.78%)</td>
<td>37(46.25%)</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>0</td>
<td>8(100%)</td>
<td>8(10%)</td>
<td></td>
</tr>
</tbody>
</table>
Table (2) EML4-ALK CISH in relation to type of tissue, grade and stage of NSCLC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumor type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADC</td>
<td>5(12.5%)</td>
<td>35(87.5%)</td>
<td>40(50%)</td>
<td>0.01</td>
</tr>
<tr>
<td>SCC</td>
<td>1(2.5%)</td>
<td>39(97.5%)</td>
<td>40(50%)</td>
<td></td>
</tr>
<tr>
<td>Tumor Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade I</td>
<td>0</td>
<td>15(100%)</td>
<td>15(18.75%)</td>
<td>0.045</td>
</tr>
<tr>
<td>Grade II</td>
<td>1(4%)</td>
<td>24(96%)</td>
<td>25(31.25%)</td>
<td></td>
</tr>
<tr>
<td>Grade III</td>
<td>5(12.5%)</td>
<td>35(87.5%)</td>
<td>40(50%)</td>
<td></td>
</tr>
<tr>
<td>Tumor size (T)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>0</td>
<td>10(100%)</td>
<td>10(12.5%)</td>
<td>0.707</td>
</tr>
<tr>
<td>T2</td>
<td>0</td>
<td>25(100%)</td>
<td>25(31.25%)</td>
<td></td>
</tr>
<tr>
<td>T3</td>
<td>5(13.51%)</td>
<td>32(86.49%)</td>
<td>37(46.25%)</td>
<td></td>
</tr>
<tr>
<td>T4</td>
<td>1(12.5%)</td>
<td>7(87.5%)</td>
<td>8(10%)</td>
<td></td>
</tr>
</tbody>
</table>

Table (3) Correlation between IHC expression of ALK and CISH in relation to the type of the tumor

<table>
<thead>
<tr>
<th>Histological Type</th>
<th>Total</th>
<th>ALK IHC</th>
<th>ALK CISH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>negative</td>
</tr>
<tr>
<td>ADC</td>
<td>40(50%)</td>
<td>7(17.5%)</td>
<td>33(82.5%)</td>
</tr>
<tr>
<td>SCC</td>
<td>40(50%)</td>
<td>1(2.5%)</td>
<td>39(97.5%)</td>
</tr>
<tr>
<td>Total</td>
<td>80(100%)</td>
<td>8(12.5%)</td>
<td>72(90%)</td>
</tr>
</tbody>
</table>

Figure (1): Normal brain tissue positive for ALK (positive control).
Figure (2): IHC cytoplasmic staining pattern of ALK, Grade II, score+2 ADC (10X).
Figure (3): IHC cytoplasmic staining pattern of ALK, Grade II, score+3 ADC (40X).

Figure (4): Grade II SCC negative for ALK protein  (X40).

Figure (5): Grade I ADC showing no ALK-EML4 genetic translocation at (40X).

Figure (6): SCC Grade III showing ALK-EML4 genetic translocation, break a part pattern at (40X).

Figure (7): Grade I ADC showing ALK-EML4 genetic translocation, IRS pattern (40X).
Discussion

In this study, we have demonstrated that the expression of ALK protein and EML4-ALK in patients with NSCLC were associated with different clinicopathological characteristics. The prevalence of high ALK protein and EML4-ALK in patients with ADC was more common than SCC and associated with high clinical importance because the tyrosine kinase inhibitor drug was recently approved, therefore there is an urgent clinical need for fast and reliable ALK tests. ALK overexpression in NSCLC is variable, ranging from 0.4–15% (24,25). These variations were due to differences in applied scoring criteria for the assessment of ALK overexpression, tumor heterogeneity and variability in staining protocols (26).

Our results agreed with (27) who found that (22/373) 5.9% of lung carcinoma were positive for ALK IHC. Also, our results agreed with those reported by (28) who found that (3/207; 1.4%) cases of lung SCC were positive for ALK detected by IHC. However; our results disagreed with (29) who found that ALK overexpression in (8/51; 15.7%) of lung ADC.

EML4-ALK genetic translocation was found in 6/80 (7.5%) of NSCLC cases. These results agreed with (27) who found that the CISH-determined ALK status was achieved in 449 patients (96.6%), and ALK rearrangement was identified in 18 patients (4.0%) in CISH method and he stated that there was high concordance in the ALK gene status and ALK protein expression between CISH and IHC tests (κ = 0.82). In this study, we found a great variety of signal patterns in ALK-positive lesions. In neoplastic nuclei, the interstitial intra-chromosomal inversion occurs on chromosome 2p which leads to the formation of an EML4-ALK fusion gene. This subtype of rearrangement may also result in break-apart patterns. However, as the genetic distance between both genes is only 13Mb, the gap between the red probe signal (flanking the ALK gene telomerically at the 3’ end, which contains the related tyrosine kinase domain) and the green signal (spanning the ALK gene centromerically to the break point) can be small. For that reason, we set the threshold for the minimal distance between red and green signals to be regarded as break apart signals. Also, we have observed that rearranged alleles were frequently amplified, resulting in multiple isolated red 3’ signals or break apart signals.

The results of current study found that there was high correlation between IHC expression of ALK and CISH results regarding the type of the tumor (P= 0, r= 0.94) as seen in Table (3) and most of cases of NSCLC with ALK intensity scoring +2,+3 IHC are need for further CISH test while the cases with ALK Intensity scoring 0,+1 IHC do not need further CISH.

Conclusion

CISH is a highly practical method to detect ALK gene rearrangement and correlated well with ALK protein expression. CISH allows a concurrent analysis of histological features of the tumors and gene rearrangement. It is a useful method in detection of ALK gene rearrangement, therefore, the detection of the EML4 CISH test might be useful in certain cases.

Ethical Clearance: The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding.

References

6- Chen H, Goldberg MS. “A systematic review of the relation between long-term exposure to ambient of isolated red signals.


Study the Relationship between TEX101 Protein, Inhibin B and Testosterone Hormone in Azoospermia and Severe Oligospermia in Infertile Patients

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¹Department of Biology-College of Science/University of Kufa,
²Department of Anatomy & Histology - College of Medicine/University of Kufa

Abstract

Background: Infertility remains a global health challenge with devastating psycho-social consequences in many Iraqi communities and an underlying long-term risk for separation of couples. Therefore, this study was aimed to determine the effect of a biochemical marker; Testis-expressed sequence 101 protein (TEX101) and relation with Inhibin hormone and testosterone on infertile couples of (Middle Euphrates center) in Iraqi population. Method: The study involved analysis of semen parameters in accordance with the criteria set by World Health Organization in the Fertility Centre in Al-Sadder Teaching Hospital in Al-Najaf/ Iraq and postgraduate Laboratory at Biology Department/College of Science, University of Kufa during the period from 1st April 2018 to 30th August 2018 of (53) Azoospermia infertile patients samples, (50) severe oligospermia samples and (50) samples of fertile subjects (control group). The biochemical marker was achieved by ELISA method. Results: The result of current study of biochemical markers showed decrease (P<0.05) in TEX101, Testosterone hormone and inhibin B in azoospermia. Also, the study showed that TEX101, Inhibin B and Testosterone were positively associated with sperm concentration, sperm motility and normal sperm morphology. Conclusion: TEX101 positively related with Inhibin B and testosterone hormone and semen normal parameters.

Keywords: TEX101, Inhibin B, Testosterone, Azoospermia, infertility.

Introduction

TEX101 protein (encoded by testis expressed 101 gene, Tex101) was originally identified by (1). TEX101 is a testicular germ cell-specific protein predominantly located on the plasma membrane of germ cells during gametogenesis. TEX101 is not expressed in any other human tissue or cell type, including Sertoli and Leydig cells of the testicular tissue (2). TEX101 is present on the cell surface during all stages of spermatogenesis. Moreover, (3) intended to examine the fate of mouse TEX101 during sperm transport through the male reproductive tract. They reported that TEX101 is eventually cleaved and released from the cell surface of epididymal sperm while it passes through the caput epididymis. Spermatozoa are, inarguably, the most highly differentiated cell type of the human body, numerous distinct processes need to be completed for generating mature and functional spermatozoa that have the ability to fertilize the oocyte based on the fact that TEX101 accompanies sperm, either anchored to its membrane, or shed into seminal plasma (SP) (4). The SP proteome of healthy fertile men before and after vasectomy. Furthermore, (5) identified a TEX101, had the top candidates for developing biomarkers of vasectomy success. In the follow-up study, 30 of those biomarker candidates were verified in pre- and post-vasectomy SP samples as well as SP from patients with non-obstructive azoospermia (NOA), several testis-specific proteins, such as TEX101, were identified as key male infertility biomarkers (2).
pituitary to secret Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH) will result in disruption of testicular function to secrete testosterone leading to imbalance of spermatogenesis (6). In addition, serum inhibin B has emerged as a sensitive marker of male fertility (7). FSH induces the Sertoli cells to secrete inhibin and androgen-binding protein and plays a major role in initiation and progression of spermatogenesis. Inhibin acts as an FSH inhibitor secreted from the Sertoli cells, while activin is secreted by the Sertoli cells and the pituitary gland and stimulates FSH secretion (8).

**Material and Method**

Semen specimens were collected from patients and controls after 3-5 days of sexual abstinence directly in a dry, clean and sterile disposable container by masturbation in a quiet room adjacent to the laboratory of seminal fluid analysis, analysis and classification of infertile patients was performed according to (9). After analysis the liquefied specimens were examined under microscope device then samples were centrifuged (3000rpm/min) for 5 minutes to separate the plasma from other components of the semen. The seminal plasma was withdrawn by micro pipette and then placed in Eppendorf tubes for making biochemical tests and stored at -20°C, the blood samples were obtained from persons by withdrawing 3ml of blood by using sterile medical syringes from brachial vein. Samples were centrifuged (3000rpm/min) for 5 minutes to separate the serum, then measured TEX101 in semen and testosterone, Inhibin B in serum by immunological technique (Enzyme-Linked-Imuno-Sorbernt-Assay) by using ELISA device.

**Statistical Analysis**

The well-known statistical system (Graph Pad prism ver. 5) was adopted, and the analysis of variance table one – way anova (by Tukey’s multiple comparisons test) was used for the comparison among subdivided groups in the measured parameters. The results were expressed as (Mean±Stander Error). Correlation coefficients were calculated to estimate the correlation between markers and parameters. The descriptive statistics and correlation coefficients were performed by using mega stat (Version v 10.12) for excel 2007 (10).

**Results**

Seminal fluid analysis of semen specimens showed a significant difference (P<0.05) in some parameters (Table 1). The results indicated a significant decrease (P<0.05) in the sperm concentration and volume ejaculation in infertile patient Azoospermia and Severe Oligozoospermia compared with control group. In addition, significant decrease (P<0.05) in sperm motility and normal sperm morphology in Azoospermia and severe Oligospermia compared with control group. Also, a significant increase (P<0.05) in the round cells in both Azoospermia and severe oligospermia in comparison with controls (Normospermia).

**Table (1) Seminal fluid parameters in infertile and fertile males**

<table>
<thead>
<tr>
<th>Semen and Sperms Parameters</th>
<th>Control group N=50</th>
<th>Severe oligo N=50</th>
<th>Azoospermia N=53</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume ( ml)</td>
<td>3.3±0.11 a</td>
<td>2.0±0.13 b</td>
<td>1.6±0.07 C</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>PH</td>
<td>7.4±0.02 a</td>
<td>7.8±0.02 A</td>
<td>6.5±0.03 B</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Concentration (Sperm/ml.)×10^6</td>
<td>77.6 ± 3.9 a</td>
<td>4.755±0.5 C</td>
<td>0.0 C</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Sperms Progressive motile (%)</td>
<td>69.0±1.5 a</td>
<td>23.1±1.6 C</td>
<td>0.0±0.0 B</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Sperm normal morphology(%)</td>
<td>62.5±2.5 a</td>
<td>7.7±0.8 b</td>
<td>0.0±0.0 c</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Round cell concentration ×10^6 cells</td>
<td>1.18±0.15 a</td>
<td>2.47±0.23 b</td>
<td>3.16±0.17 c</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

Values were mean ±SE. Total number of patients= 103.
The results of statical analysis showed a significant decrease (P<0.05) of TEX101 protein level in infertile men Azoospermia (148.5±13.7) and Severe oligospermia (180±19.1) compared with control group (339.7 ± 11.7) a) figure (1). Also showed a significant decrease (P<0.05) of Inhibin B level in Azoospermia (6.4±0.28) and severe oligospermia (8.3±0.3) compared to Inhibin B level of control group (12.2±0.34) (Figure 2). Significant decrease (P<0.05) of testosterone level in Azoospermia (2.26 ± 0.22) and severe oligospermia (3.9±0.32) compared to testosterone level of with fertile men controls (7.31±0.14).

Figure (1) Level TEX101 protein in the seminal plasma of infertile men and fertile men (control)

Figure (2) Inhibin B level in serum of infertile men and fertile men (control).

The study showed presence of positive correlation between TEX101 markers with sperm concentration, sperm progressive motile and sperm normal morphology (Figure 3).

Figure (3) Correlation between TEX101 concentration and sperm concentration.

The study showed positive correlation between Inhibin B markers with sperm concentration, sperm progressive motile and sperm normal morphology, respectively, (Figure 4). Also, the results showed positive correlation between testosteron hormone with sperm concentration, sperm progressive motile and sperm normal morphology (Figure 5).

Figure (4) Correlation between Inhibin B and sperm concentration of infertile men.

Figure(5) Correlation of Testosterone and sperm concentration of infertile men.

The study showed the presence of a positive correlation between TEX101 proteins, Inhibin B, Testosterone hormone (Figure 6).
The results showed a significant decrease (P<0.05) of TEX101 protein level in infertile men azoospermia and severe oligospermia compared with fertile control group and showed positive correlation between sperms concentration, progressive motile, sperms normal morphology and TEX101 level these results may be effected in the protein synthesis that comes from a defect in the gene expression which is responsible for the protein production . Studies have confirmed that the TEX101 is essential for human fertility. Spermatogenesis processes need to be completed for generating mature and functional spermatozoa that have the ability to capacitating processes, based on the fact that TEX101 accompanies sperm, either anchored to its membrane, or shed into seminal plasma (3).

A study by (11) showed that in different patients, Azoospermia, Oligospermia men infertility was diagnosed and found to alter or lack the TEX101 gene, this provided a proof that TEX101 is a germ cell marker glycoprotein involving in gametogenesis (12). It is later found on spermatocytes, spermatids and testicular sperms after the onset of puberty and is shed as sperms that pass the caput epididymis (3).

The results agreed with a study by (13) showed a positive correlation between TEX101 protein expression and semen and sperm parameter TEX101 protein expression which was positively significantly correlated with sperm concentration, sperm progressive motility in addition to sperm normal morphology. This fact suggested that TEX101 expression per germ cell may vary in different individuals, the fraction of TEX101 cleaved from the surface may vary or TEX101 was released into SP not only by epididymal spermatozoa, but also by testicular germ cells.

Normal expression of the TEX101 is associated with progressive motility and acrosome reaction, while abnormal channel expression may be involved in the pathogenesis of Azoospermia ,specifically, disruption of the TEX101 genes in mice causes male infertility with findings of immotile spermatozoa and failed hyperactivated motility in unexplained infertile and asthenospermia. These studies found that TEX101 protein has significant decrease (P<0.05) in infertility patients especially in azoospermia compared with healthy men (12,14).

The present study agreed with (15) revealed that inhibin B levels are significantly reduced in men with infertility problems, irrespective of etiology, compared with fertile men. So that, the present study also agreed with them when said that inhibin B levels are more sensitive markers of male factor infertility than other available hormones. These results may be due to the differences in the etiology of infertility such as external factors or internal histological or physiological factors.

The present study showed positive correlation between Testosterone hormone with TEX101 marker. Proteins deficiencies are the most promising molecules to develop infertile biomarkers. Alternations in protein abundance and activity in different physiological states reflect dynamic alternations which may hardly be predicted at the genome level (16). LH stimulates the production of testosterone by the Leydig cells, and in turn acts on the sertoli and peritubular cells of the seminiferous tubules to stimulate spermatogenesis. Testosterone is essential for growth and division of germinal cells in forming spermatozoa (17).

TEX101 mutations of the X chromosome were recently noted in array comparative genomic hybridization study, affecting germ cells in testis, caused meiotic arrest, disruption of hormone function and azoospermia (18). TEX101 codes for a testis-specific meiotic protein that regulates DNA double-strand break repair and has proven essential to normal spermatogenesis in mouse models (19).

Conclusions and Recommendations

The results concluded that TEX101 related positively with testosterone and Inhibin B hormone and semen normal parameters included sperm concentration, motility and normal sperm morphology. It is recommended to search for genetic study of TEX101
mutation and histological and physiological effects on sexual hormone imbalance in males.

**Ethical Clearance:** The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

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**References**


Serum Caspase 3 and Lysozyme level in abortive Iraqi Women Infected with *Toxoplasma gondii* and Urinary Tract Infections

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²University of Al-Nahrain/ Biotechnology Research Center

Abstract

**Background:** Toxoplasmosis is one of a number of worldwide diseases which is related to abortion. Many researchers had attempted to find the exact factors that can lead to abortion. This study was aimed at focusing on other factors which may direct pregnant women towards abortion. **Method:** This study included 75 abortive Iraqi women and 25 apparently healthy pregnant women as control group. All participants were subjected to several immunological tests (caspase-3, lysozyme, IgG and IgM) as well as urine test (for the isolation and characterization of aerobic bacteria). **Results:** The results demonstrated that most early abortions occurred due to infection with *Taxoplasma gondii* (*T. gondii*), whereas abortion in the latter stages of pregnancy occurred due to the urinary tract infection (UTI). *S.aureus* was the most prevalent bacteria isolated from abortive women infected with UTI or in combination with toxoplasmosis. The most prevalent immunoglobulin was IgG, and all groups recorded increase in the concentration of caspase-3 at all three trimesters of pregnancy, particularly in women dealing with *T. gondii* infection only (223±10.7, 229±14.07 and 226±11.75 ng/ml with non-significant differences. Also, a significant increase in the level of lysozyme which again was recorded across all study groups, especially in women infected with *T. gondii* and UTI (22±1.57, 16±0.74 and 15±0.47) ng/ml.

**Keywords:** Toxoplasmosis, *T. gondii*, caspase-3, lysozyme, UTI, pregnancy.

Introduction

Toxoplasmosis is a disease caused by *T. gondii*, an obligate intracellular parasite. Cats play an important role in the spread of *T. gondii* and in the completion of its life cycle [¹]. The parasite can infect about 30-50% of the world’s human population. Clinically, it is considered an asymptomatic disease in spite of the life-long presence of the parasite in the tissues of infected individuals [²]. *T. gondii* has several effects including alteration of human behavior, schizophrenia is one of the mental disorders that has been linked to the parasite when the infection reaches the brain. Great efforts have been devoted to studying the effects of this parasite on human health [³]. In addition to miscarriages amongst pregnant women, it may also contribute to the teratogenicity of the embryo [⁴].

Infection with *T. gondii* stimulates the innate immune system to produce several cytokines such as IL-2 and IFN-γ, which are responsible for the stimulation of CD4 and CD8 to eradicate the infection. The parasite causes the formation of cysts which are deposited in the muscles and the brain of the infected host due to activated natural killer cells (NK) [⁵]. Programmed cell death (PCD) is the most important host resistance mechanism to defend against intracellular pathogens such as *T. gondii* [⁶]. During acute infection, inflammatory responses lead to the instigation of PCD. Activation of caspase-9 consequently cleaves a series of effector caspases-3, -6 and -7 [⁷]. On the other hand, previous researchers have documented the ability of the parasite to produce lysozyme which is significant in relation to hyaluronidases for the penetration of the parasite throughout the mammalian cell [⁸]. Lysozyme is a polypeptide which is found in tissues and fluids (e.g. serum), and is an important contributor to the mechanism of native immunity [⁹]. Thus, the main goal of this study was to explore the effects of *T. gondii* and UTIs on a number of host immune parameters such as IgG, IgM, caspase-3 and lysozyme levels which may be related to abortion.
Materials and Method

The present study was conducted in the eastern side of Baghdad city, Iraq, throughout the period from December 2016 to June 2017. The study was carried out on 75 abortive women divided into three groups: a) women suffering from toxoplasmosis, b) women suffering from UTI and c) women suffering from both toxoplasmosis and UTI. In addition, apparently healthy pregnant women were included as control group).

Blood collection: By using a sterile gel tube (Afco-dispo/ Jordan), a 5-ml venous blood sample was obtained from each patient and control subject. After centrifugation at 3000rpm for 5 minutes, the serum was collected and kept at -20°C for immunological tests.

Urine collection: Dependent on [10], midstream urine samples were collected in a sterile container and characterized the bacterial isolates using standard microbiology techniques.

Immunological tests: The enzyme-linked immunosorbent assay (ELISA) technique (Bio Check/ Europe) was used to determine the level of IgG and IgM antibodies. The concentrations of caspase-3 and lysozyme were defined via Myo biosource / USA kits.

Bacterial detection: By using VITEK 2, an automated instrument for ID/AST testing, all specimens were characterized and separated according to the determinant groups.

Statistics analysis: A 2012 statistical analysis system (SAS) was used to study the effect of different factors and parameters. A chi-squared test was employed to obtain significant comparisons between percentages, and the least significant difference (LSD) tests (ANOVA) were employed to achieve comparisons between means[11].

Results and discussion

The percentage of abortions during the gestational period

The results, as seen in Table 1, showed that most early abortions occurred due to infection of T. gondii, and particularly during the first trimester of pregnancy (48%, 40% and12%. In spite of bacterial infection causing UTIs, T. gondii apparently appeared to be the main factor responsible for abortion. In addition, results demonstrated that amongst UTI group, abortion occurred later into the pregnancy (20%, 32% and 48%).

<table>
<thead>
<tr>
<th>Type of infection</th>
<th>1st trimester</th>
<th>2nd trimester</th>
<th>3rd trimester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxoplasma</td>
<td>48%</td>
<td>40%</td>
<td>12%</td>
</tr>
<tr>
<td>UTI</td>
<td>20%</td>
<td>32%</td>
<td>48%</td>
</tr>
<tr>
<td>Toxoplasma and UTI</td>
<td>48%</td>
<td>28%</td>
<td>24%</td>
</tr>
</tbody>
</table>

Table 1: The percentage of abortion according to stage of pregnancy

Thus, the best explanation of this results may be that UTIs may arise due to vaginal infections caused by anatomical proximity. This speculation appears to be in agreement with [12] who mentioned the role of systemic infections such as viral, parasitic and bacterial vaginosis in miscarriages . Furthermore, [13] reported that around 78% of total samples from aborted cases suffered from bacterial infections . This study paid particular attention to characterizing the bacteria that causes UTIs. The results in Table (2 established that the most prevalent bacteria was Staphylococcus aureus followed by Escherichia coli, Klebsiella pneumoniae, Streptococcus spp. and Staphylococcus epidermidis in descending order of prevalence, depending on the percentage of bacterial isolations.

Table 2 Number and percentage of bacteria isolated from abortive women infected with UTI alone and infected with UTI plus toxoplasmosis

<table>
<thead>
<tr>
<th>Groups</th>
<th>S. aureus</th>
<th>E. coli</th>
<th>K. pneumoniae</th>
<th>Streptococcus spp.</th>
<th>S. epidermidis</th>
<th>Chi-Squared test ($\chi^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having urinary tract infection</td>
<td>10 (40%)</td>
<td>6 (24%)</td>
<td>4 (16%)</td>
<td>4 (16%)</td>
<td>1 (4%)</td>
<td>9.54 **</td>
</tr>
<tr>
<td>Having toxoplasmosis and urinary tract infection</td>
<td>19 (76%)</td>
<td>4 (16%)</td>
<td>1 (4%)</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
<td>13.60 **</td>
</tr>
<tr>
<td>Chi-Squared test ($\chi^2$)</td>
<td>8.73 **</td>
<td>4.38 *</td>
<td>4.69 *</td>
<td>4.9**</td>
<td>1.27 NS</td>
<td>----</td>
</tr>
</tbody>
</table>

* (P<0.05), ** (P<0.01), NS: Non-Significant.
The effect of Toxoplasmosis and bacterial UTIs on aspects of the immune system in abortive women

The results in Table (3) illustrate non-significant elevation in caspase-3 levels in all three trimesters of pregnancy in women infected with toxoplasmosis only (223±10.7, 229±14.07 and 226±11.75ng/ml, respectively, in comparison with control group (119±5.5, 117±8, 115±9.7ng/ml, respectively. This result was in line with [14,15] who documented that their findings about the relationship between T. gondii infection and the induction of apoptosis and necrosis of trophoblasts.

Table 3: Serum caspase-3 and lysozyme levels in abortive women infected with Toxoplasmosis

<table>
<thead>
<tr>
<th>No.</th>
<th>Age Range/yr</th>
<th>Gestational trimester</th>
<th>Caspase conc. (ng/ml)</th>
<th>Lysozyme conc. (ng/ml)</th>
<th>More prevalence Ab</th>
<th>(Control) Caspase conc. (ng/ml)</th>
<th>(Control) Lysozyme conc. (ng/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16-40</td>
<td>First</td>
<td>223±10.7 a</td>
<td>8±0.12 b</td>
<td>IgG</td>
<td>119±5.5a</td>
<td>3.5±0.12a</td>
</tr>
<tr>
<td>2</td>
<td>21-25</td>
<td>Second</td>
<td>229±14.07 a</td>
<td>9±0.27 a</td>
<td>IgG</td>
<td>117±8.3a</td>
<td>4±0.23a</td>
</tr>
<tr>
<td>3</td>
<td>17-21</td>
<td>Third</td>
<td>226±11.75 a</td>
<td>9±0.15 ab</td>
<td>IgG and IgM</td>
<td>115±9.7a</td>
<td>4±0.11a</td>
</tr>
</tbody>
</table>

LSD value 17.284 NS 0.795 * --- 10.521NS 0.542NS

Moreover, the results were in line with [16,17] who documented the role of T. gondii infection in apoptosis of trophoblast cells, and this is considered the direct reason for miscarriage amongst women. This is also backed up by [18] who found that T. gondii infection increased and subsequently conserved caspase-3, caspase-8 and the apoptosis of trophoblast co-cultured with NK cells in vitro. Also, they speculated that the reason may be related to the IFN-γ level which is associated with the apoptosis of trophoblast.

Furthermore, results revealed a significant increase in lysozyme concentration in all three trimester of pregnancy (8±0.12, 9±0.27 and 9±0.15ng/ml, respectively, because this enzyme acts as one of the innate defense mechanisms found extracellularly as well as intracellularly in some congenital immune cells, especially macrophage and dendritic cells [19]. The effect of caspase-3 appeared throughout the hypothesis of [20]. They supposed that progesterone sustains uterine quiescence through the ruling of active uterine caspase-3, and progesterone production needed activation of caspase-3, thus proposing its relationship with diminished progesterone action during the final phase of pregnancy, this increase in the level of caspase-3 during the pregnancy period is important for the maintenance of the pregnancy. Their findings were verified by the results of this paper that caspase-3 plays a role in the early stage of luteolysis in corpus luteum, and elevations in the activity of caspase-2, -8, -9, and -3 were related to the early actions of natural luteolysis at the end of pregnancy. The results in Table (4) showed significant increase in caspase 3 in all trimesters of women infected with UTI (174±8.3, 243±11.7, 197±9.1ng/ml, respectively, in comparison with control group (119±5.5,117±8.3,115±9.7ng/ml, respectively.

Table 4 Serum caspase-3 and lysozyme enzyme levels in women infected with bacterial UTI

<table>
<thead>
<tr>
<th>No.</th>
<th>Age range/yr</th>
<th>Gestational Trimester</th>
<th>Caspase conc. (ng/ml)</th>
<th>Lysozyme conc. (ng/ml)</th>
<th>(Control) Caspase conc. (ng/ml)</th>
<th>(Control) Lysozyme conc. (ng/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22-33</td>
<td>First</td>
<td>174±8.3 b</td>
<td>7 ± 0.3 b</td>
<td>119±5.5a</td>
<td>3.5±0.12a</td>
</tr>
<tr>
<td>2</td>
<td>18-40</td>
<td>Second</td>
<td>243±11.7 a</td>
<td>13 ± 0.7 a</td>
<td>117±8.3a</td>
<td>4±0.23a</td>
</tr>
<tr>
<td>3</td>
<td>19-34</td>
<td>Third</td>
<td>197±9.1 b</td>
<td>12 ± 0.5 a</td>
<td>115±9.7a</td>
<td>4±0.11a</td>
</tr>
</tbody>
</table>

LSD value 27.492 * 2.863 * 10.521NS 0.542NS

* (P<0.05). Means having with the different letters in same column differed significantly.
As mentioned earlier, the level of caspase-3 was significantly higher in all groups. This increase may be related to some form of hormonal change, such as the human chorionic gonadotropin (HCG) hormone [21]. In addition, the results in Table (4) revealed a significant increase in lysozyme concentration in all trimesters of aborted women infected with UTI (7±0.3, 13±0.7, 12±0.5ng/ml, respectively, in comparison with control group(3.5±0.12, 4±0.23, 4±0.11ng/ml, respectively. Increased caspase-3 and lysozyme levels are directly correlated with the role of infection in abortion and may be associated with the secretion of bacterial cytolytic toxins. The results in Table (5) demonstrated that the role of both infections translated into a non-significant elevation of caspase-3 (171±7.82, 162±7.02, 171±8.36ng/ml, respectively, in comparison with control group (119±5.5, 117±8.3, 115±9.7 ng/ml, respectively, and significant elevation of lysozyme (22±1.57, 16±0.74, 15±0.47ng/ml, respectively, in comparison with control group (3.5±0.12, 4±0.23, 4±0.11ng/ml, respectively.

### Table 5 Serum caspase-3 and lysozyme enzyme levels in women infected with Toxoplasmosis and UTI

<table>
<thead>
<tr>
<th>No.</th>
<th>Age range/yr</th>
<th>Gestational trimester</th>
<th>Caspase conc. (ng/ml)</th>
<th>Lysozyme conc. (ng/ml)</th>
<th>(Control) Caspase conc. (ng/ml)</th>
<th>(Control) Lysozyme conc. (ng/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18-40</td>
<td>First</td>
<td>171 ± 7.82 a</td>
<td>22 ± 1.57 a</td>
<td>119±5.5a</td>
<td>3.5±0.12a</td>
</tr>
<tr>
<td>2</td>
<td>18-32</td>
<td>Second</td>
<td>162 ± 7.02 a</td>
<td>16 ± 0.74 b</td>
<td>117±8.3a</td>
<td>4±0.23a</td>
</tr>
<tr>
<td>3</td>
<td>17-32</td>
<td>Third</td>
<td>171 ± 8.36 a</td>
<td>15 ± 0.47 b</td>
<td>115±9.7a</td>
<td>4±0.11a</td>
</tr>
<tr>
<td>LSD value</td>
<td>14.966 NS</td>
<td></td>
<td>3.783 *</td>
<td>10.521NS</td>
<td>0.542NS</td>
<td></td>
</tr>
</tbody>
</table>

* (P<0.05), NS: Non-Significant. Means having with the different letters in same column differed significantly.

Furthermore, [22] explained that homologous mammalian lysozymes have specific effects on the in vitro growth patterns and morphology of normal and transformed mammalian cells, apparently due to the impact on the membrane component [22]. Hence, these results suggested that the reduction mechanism occurred between both causative agents in the induction of caspase-3 release, yet [23] supposed that the effect of Enterococcus faecalis (E. faecalis), a causative agent of UTIs, revealed that active isolate physiology was important for the inhibition of host cell apoptosis, and this feature seemed to be a strain-independent trait among E. faecalis isolates [21]. The results of current study suggested that the first suspension of an abortion is indicated by the increased levels of lysozyme and caspase-3.

**Ethical Clearance:** The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

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**References**


Topical Effect of Silver Diamine Fluoride in Arresting Dental Caries in Primary Teeth

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Abstract

Dental caries a common childhood disease that destroy dental hard cellular tissue due to bacterial acidic products. Topical application of SDF provide caries protective activity and short term application need to be evaluated.

Forty primary school children were subjected to 38% SDF treatment. They were divided into two groups, 19 children randomly treated with placebo (liquid A), and 19 treated with (liquid B) SDF. Children have at least one active caries lesion with exposed dentin (level 3) and healthy medical history. One drop was applied for each lesion and left for 2min.

After three weeks of follow-up, 26.3% of decayed teeth in the SDF group showed hard arrested dentine and the placebo group showed 2.6% of dental caries arrest (p < 0.001). After six months, follow up showed that SDF group had 31.5% of the arrested cavities and the control group had 2.6 % (p < 0.001).

The preventive fraction showed that SDF decreased dental caries from 26.3% to 31.5%, respectively, when compared to the control placebo group that shows no change in caries arrest activities.

SDF short-term treatments, may decrease the need for emergent dental treatment for untreated early Childhood Caries.

Keywords: SDF, Dental Caries, Children

Introduction

Dental caries a common childhood disease that destroy dental hard cellular tissue due to bacterial acidic products. Early interventions are necessary to stop tooth decay in children [1, 2]. Fluoride varnish provides best preventive service as a topical application every 3 to 6 months especially to those with less dentists’ contact [2, 3]. Topical silver diamine fluoride (SDF) is a clear liquid with antimicrobial and enzyme (collagenase) inhibitor activity that stops the lesion and increase the enamel mineral density through calcium fluoride deposition[4-10]. Recent studies, had reported that once a year application of SDF is enough to prevent new caries and existing caries arrest [11-13].

The aim of this study is to examine the short-term effect and safety of SDF (38%).

Materials and Method

The total number of participating children (primary school) was 40 children who assigned for biannual applications of 38% SDF (Saforide-38%, Tokyo Seiyaku kasei, Japan).

This study was conducted between 20/2/2018 until 4/10/2018. Generally, the participants were private pediatric dental Clinic patients 5 to 7 years children who have at least one active caries lesion with exposed dentin (level 3) and healthy medical history. Those sensitive to SDF or any other heavy-metal ions and any gingival
Cotton rolls were used to separate teeth from saliva and petroleum jell was used to protect gingival tissue. One drop was applied for each lesion and left for 2min.

Results

The sample comprised 40 preschool children, the mean age 5-7 years; 18 children (45%) were 5 years, and 22 children (55%) were 7 years old (table 1).

The treatment was continued on 38 children (97%) since one child of each group, did not continue with the follow-up.

The 38 children divided into two groups, 19 children randomly treated with placebo (liquid A), and 19 treated with (liquid B) SDF. After three weeks of follow-up, 26.3% of decayed teeth in the SDF group showed good arrested dentine and the placebo group showed 2.6% of dental caries arrest (p < 0.001) (table 2). After six months, follow up showed that SDF group had 31.5% of the arrested cavities. The control group had 2.6 % (p < 0.001).

The preventive fraction showed that SDF decreased dental caries from 26.3% to 31.5%, compared with the control placebo group that show no change in caries arrest activities (table 3).

Discussion

In this study, primary teeth with dentinal lesions were collected from 5-7 years-old children receiving one topical application of 38% SDF with follow up after one and 6 months.
concentration (38% versus 12%) and longer treatment period with repeated treatment [4,5,8,11,13].

**Conclusion**

This study documents short-term effect of SDF in arresting dental caries with single application of SDF. Such treatments, may decrease the need for emergent dental treatment for untreated early Childhood Caries.

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors have no conflict of interest.

**Funding:** Self-funding

**References**


Do Dental Arches Lengths, Widths and Perimeters affect Bolton’s Ratios?

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²Department of Orthodontics, College of Dentistry, University of Baghdad, Baghdad, Iraq

Abstract

Background: The main objectives in treating any orthodontic case are establishing stable occlusion with normal overjet and overbite class I canines relationship and good teeth interdigitation with appropriate proportion of maxillary and mandibular teeth widths. Bolton in 1958 introduced his analysis depending on the study models of fifty five cases with excellent occlusion, of which 44 cases were treated orthodontically (non-extraction) and 11 cases were untreated. He developed two ratios one related the whole teeth anterior to the second molars and the other from canine to canine. The aim of this study was to test whether Bolton’s tooth size ratios were affected by the maxillary and mandibular dental arch widths, lengths and perimeter.

Materials and Method: This investigation was performed on a sample of dental casts belong to sixty Iraqi individuals. Anterior and overall tooth size ratios, dental arches widths, lengths and perimeters of maxillary and mandibular arches were measured using digital caliper. Pearson’s correlation coefficient test was used to test the relation between the anterior and overall Bolton’s ratios with the dental arches parameters. Results: The mean values of anterior and overall Bolton’s ratios were near to that reported by original study of Bolton. Statistically, there was no relationship between dental arch parameters and Bolton’s ratios. Conclusions: Dental arch widths, lengths, perimeter had no effect on Bolton’s ratios.

Key words: Bolton’s ratio, arch widths, arch lengths, arch perimeters, tooth size.

Introduction

The main objectives in treating any orthodontic case are establishing stable occlusion with normal overjet and overbite class I canines relationship and good teeth interdigitation with appropriate proportion of maxillary and mandibular teeth widths (1,2).

Bolton(3) in 1958 introduced his analysis depending on the study models of fifty five cases with excellent occlusion, of which 44 cases where treated orthodontically (non-extraction) and 11 cases were untreated. He developed two ratios one related the whole teeth anterior to the second molars and the other from canine to canine. These ratios are universal and have consideration in developing treatment planning for any case, aiding in determining the extraction or inter-dental reduction in crowding cases or composite build-up in spacing cases.

The literature is rich in research and review articles regarding Bolton’s ratios. Many researches developed the normal values of these ratios in different racial groups (4,5), as the mesio-distal widths of the teeth varies in different ethnic groups, while others discussed the effects of various parameters on these ratios like the effect of gender (4-8), method of measuring (9-12), types of malocclusion (13-18), degree of overbite and overjet, labio-lingual thickness of upper incisors, mesio-distal tipping of upper incisors (19), dental arches dimensions and forms (20) and finally the effect of dental extraction (21,22).

The aim of this study was to find whether the dental arch width, length and perimeter have an effect on Bolton’s ratios.
Materials and Method

Samples

This study was conducted on sixty pairs of dental casts belonged to sixty Iraqi individuals selected randomly, according to specific inclusion criteria, from patients attending the Orthodontic Department at Al-Rafidain University College, Baghdad/Iraq.

Inclusion criteria

• Subjects were of Iraqi Arab origin aged 15–28 years with full permanent dentition regardless of third molars.
• Normal occlusion with bilateral Class I molars and canines relationships.
• Maxillary and mandibular well-aligned arches with less than 3mm crowding or spacing.
• No history of trauma nor previous orthodontic, prosthetic treatment, maxillofacial or plastic surgery.
• No craniofacial anomalies such as cleft lip, cleft palate or both.
• Absence of gingival or periodontal problems or therapy that would demoralize a healthy tissue to tooth relationship.
• Good quality stone casts with no substantiation of air bubbles.

Exclusion criteria

• Subjects with severe crowding, excessive spacing, periodontal disease, retained deciduous teeth.
• Interproximal caries or restorations, or tooth wear that affected the tooth size measurements.
• Congenital missing or supernumerary teeth
• Abnormal teeth morphology.

Method

History and clinical examination

Consent form was signed by each subject to participate in this study then extra- and intra-oral examinations on the dental chair were done to check the participant’s fulfillment for the required sample selection criteria.

Dental impressions and casts preparation

Dental impressions for the maxillary and mandibular arches were taken for each individual using Alginate hydrocolloid impression material (Tropicalgin, Chromatic alginate, Zhermack, Italy). The impressions were then inspected for any defect, disinfected with sodium hypochlorite (1:10) solution (23) then rinsed again and poured with dental stone (Elite Rock, Sandy brown, Zhermack, Italy). A base from plaster (Plaster of Paris, Al-Ahleea Co., Iraq) was prepared using plastic molds, then participant’s name was labeled on the base and finally the casts were ready for the measuring procedure.

Measurements

The teeth widths, dental arch lengths, widths and perimeters were measured for both arches using digital vernier (Mitutoyo, Japan) with 0.01mm accuracy.

\[
\text{BAR} = \frac{\text{sum of the mandibular } 6 \text{ to } 6}{\text{sum of the maxillary } 6 \text{ to } 6} \times 100
\]

\[
\text{BOR} = \frac{\text{sum of the mandibular } 3 \text{ to } 3}{\text{sum of the maxillary } 3 \text{ to } 3} \times 100
\]

Teeth width measurements

The greatest mesial-distal distance, measured from the buccal view, was obtained by measuring the distance from anatomical contact of one tooth to another on a line parallel to occlusal surfaces and perpendicular to the long axis of the teeth (24).

Teeth widths were utilized to calculate Bolton’s anterior ratio (BAR) and Bolton’s overall ratio (BOR) with the application of the subsequent equations (3)

Arch length (AL)

Arch length was obtained using triangular shaped lines between the mesio-buccal cusp tips of first permanent molars and the central point between the incisors of each respective arch (25).

Arch width measurements (26,27)

Maxillary and mandibular inter-canine widths (ICW) were obtained by measuring the linear distance between the right and left canines’ cusp tips.
Maxillary and mandibular inter-premolar widths (IPW) were obtained by measuring the linear distance between the buccal cusp tips of the first premolars.

Maxillary and mandibular inter-molar widths (IMW) were obtained by measuring the linear distance between the mesio-buccal cusp tips of the first molars.

Arch perimeter (AP)

Arch perimeter was measured as a segmental sum of five measurements, from the mesial of the right first molar to the distal of the right canine, from the distal of the right canine to the distal of the right central incisor, from the distal of the right central incisor to the distal of left central incisor, from the distal of the left central incisor to the distal of the left canine, from the distal of the left canine to the mesial of the left first molar (25).

Statistical analyses

The data were analyzed using SPSS (Statistical Package of Social Science; version 24, IBM Co., New York, USA). The statistical analyses included:

Descriptive statistics: Means, standard deviations, minimum and maximum values.

Inferential statistics: Pearson’s correlation coefficient test to study the relation between the anterior and overall Bolton’s ratios and the dental arches widths, lengths and perimeters.

Results

Table (1) showed the descriptive statistics of the measured variables. Table (2) demonstrated the relation between the anterior and overall Bolton’s ratios with dental arches lengths, widths and perimeters. Generally, there were no significant relations between the measured variables except for a weak significant correlation between the inter-molar width and overall ratio in the maxillary arch, and between arch length and overall ratio in the lower arch.

Table 1: Descriptive statistics of the studied variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolton's ratios</td>
<td>Overall</td>
<td>92.875</td>
<td>2.454</td>
<td>87.390</td>
</tr>
<tr>
<td></td>
<td>Anterior</td>
<td>79.080</td>
<td>3.024</td>
<td>72.273</td>
</tr>
<tr>
<td>Maxillary arch</td>
<td>ICW</td>
<td>34.487</td>
<td>2.8</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>IPW</td>
<td>41.457</td>
<td>3.093</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>IMW</td>
<td>51.265</td>
<td>3.192</td>
<td>42.6</td>
</tr>
<tr>
<td></td>
<td>AL</td>
<td>33.851</td>
<td>2.781</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>AP</td>
<td>72.129</td>
<td>4.433</td>
<td>60</td>
</tr>
<tr>
<td>Mandibular arch</td>
<td>ICW</td>
<td>26.978</td>
<td>1.969</td>
<td>23.2</td>
</tr>
<tr>
<td></td>
<td>IPW</td>
<td>34.749</td>
<td>2.373</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>IMW</td>
<td>45.091</td>
<td>2.782</td>
<td>39.9</td>
</tr>
<tr>
<td></td>
<td>AL</td>
<td>28.378</td>
<td>2.786</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>AP</td>
<td>62.946</td>
<td>3.611</td>
<td>49</td>
</tr>
</tbody>
</table>
Table 2: Relations between Bolton’s ratios and studied variables

<table>
<thead>
<tr>
<th>Arch</th>
<th>Bolton’s ratios</th>
<th>AP</th>
<th>AL</th>
<th>IMW</th>
<th>IPW</th>
<th>ICW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary arch</td>
<td>Overall</td>
<td>r</td>
<td>-0.094</td>
<td>-0.149</td>
<td>0.242</td>
<td>0.089</td>
</tr>
<tr>
<td></td>
<td></td>
<td>p</td>
<td>0.447</td>
<td>0.224</td>
<td>0.046</td>
<td>0.472</td>
</tr>
<tr>
<td></td>
<td>Anterior</td>
<td>r</td>
<td>-0.049</td>
<td>-0.104</td>
<td>0.196</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>p</td>
<td>0.693</td>
<td>0.398</td>
<td>0.109</td>
<td>0.997</td>
</tr>
<tr>
<td>Mandibular arch</td>
<td>Overall</td>
<td>r</td>
<td>0.083</td>
<td>-0.276</td>
<td>0.189</td>
<td>0.069</td>
</tr>
<tr>
<td></td>
<td></td>
<td>p</td>
<td>0.502</td>
<td>0.023</td>
<td>0.122</td>
<td>0.576</td>
</tr>
<tr>
<td></td>
<td>Anterior</td>
<td>r</td>
<td>0.128</td>
<td>-0.104</td>
<td>0.166</td>
<td>0.043</td>
</tr>
<tr>
<td></td>
<td></td>
<td>p</td>
<td>0.299</td>
<td>0.397</td>
<td>0.175</td>
<td>0.726</td>
</tr>
</tbody>
</table>

Discussion

Andrews (28) determined the famous six keys to normal occlusion, but to seat a good occlusion with proper inter-digitations in all planes of space, there must be a specific balance between the mesio-distal tooth size of the maxillary and mandibular arches (29). However, (30) concluded that this proper anterior and posterior fit could not be gained without the seventh key (Bolton’s tooth size ratio) is fulfilled.

Determination of teeth size ratio is an inter-maxillary analysis of enormous importance that needs to be routinely measured in the orthodontic practice prior to starting any orthodontic treatment in order to localize any difference in tooth size for anterior and overall discrepancy.

Since its publication in 1958, Bolton’s method of diagnosing tooth-size discrepancy has been commonly used in scientific researches and has become one of the key factors in orthodontic diagnosis and treatment planning.

Despite the availability of different types of measurement tools, in this study all the measurements were made directly on study cast with electronic calipers, as the conventional plaster study models are considered as a standard component of orthodontic records, and their analysis proved to be the most accurate, reliable and reproducible one (31-33). Moreover, (12) compared the measurements using digital calipers with OrthoCAD and found that digital calipers gave the most precise and reproducible measurements, hence electronic caliper was used in the present study. Also, (28) used CBCT in measuring dental arch and teeth dimensions. CBCT cannot be used routinely for each patient attending the orthodontic clinic unlike the study models.

The gender dimorphism in Bolton’s ratios was not considered in the present study as the findings of many previous studies proved statistically non-significant gender differences (8,13,15).

The researches depended on Bolton’s analysis for people of dissimilar races and from various countries could be very expedient for the determination of their own normative value. The Iraqi’s overall tooth size ratio was comparable to the original Bolton’s overall ratio and near to many previous Iraqi studies (34-39).

The current study investigated the effect of dental arches widths, lengths and perimeters on the Bolton’s ratios (both anterior and overall ratios) in Iraqi sample with Angle Class I normal occlusion. Generally, no significant relations were found (P≥0.05); this was in agreement with the findings of (28) regarding the arch width groups (inter-canine, inter-premolar, and inter-molar). However, (28) reported a statistically significant relation between arch length and arch perimeter with Bolton’s ratio and this could be explained by cultural and environmental differences in addition to the measuring methods differences.

Like any study, there are several inherent limitations that may exist. The sample included class I only, so class II and III with crowding and spacing of varying amount, cross bite or scissors bite, congenital missing or impacted teeth, cases indicated for orthognathic surgery should also be considered.
Conclusion

Dental arch widths, lengths and perimeters had no significant effect on Bolton’s ratios.

Ethical Clearance: The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding.

References


Evaluation of the Diagnostic Accuracy of Transient Elastography and Apri Score in Chronic Hepatitis B (CHB) in a Sample of Iraqi Patients

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Abstract

Background: Hepatitis B is a global chronic disease caused by the hepatitis B virus. Development of liver cirrhosis is one of the most important and serious complication of this infection. Aim of the study was to assess the diagnostic accuracy of transient elastography and AST to platelet ratio index (APRI) score in detecting the degree of liver fibrosis in chronic hepatitis B (CHB) patients, with biopsy samples as a reference standard. Method: Thirty-seven patients diagnosed as CHB were recruited and the stage of fibrosis was determined by biopsy. The diagnostic accuracy of FibroScan (Echosens, Paris, France) and APRI was evaluated based on the conformity of the results from these tests with those of biopsies. An expert operator performed all measurements. Metavir score was used to assess the degree for liver fibrosis. Results: The Metavir score for liver biopsies were (F0-F1 N=22, F2 N=12, F3 N=2, and F4=1), while the score assessment by Fibroscan were (F0-F1 N=24, F2 N=10, F3 N=1, and F4=2). There was a significant association between the two groups by the level of assessment method of liver fibrosis (P<0.05). The mean score for APRI, for patients with early degree of liver fibrosis (Metavir Score liver histology F0-F1) (N=22), was 0.58 (SD= 0.417), while those with advanced fibrosis (F3) their mean APRI core was 0.49. Comparing the mean of APRI score results with those of liver histology (ANOVA test), there was no significant association between the two groups (P>0.005). Conclusion: Transient elastography (FibroScan) has a reliable results in assessing the degree of liver fibrosis in CHB patients. APRI score did not show a significant association with degree of fibrosis in CHB patients.

Keywords: Hepatitis, liver cirrhosis, elastography, biopsy, APRI.

Introduction

Hepatitis B is a global chronic disease caused by the hepatitis B virus (¹). Development of liver cirrhosis is one of the most important and serious complication of this infection (²). Once cirrhotic changes in the liver started, they are irreversible and usually progressive and this represent the terminal stage of hepatitis. However, with the exception of a biopsy, there are no dependable and reliable methods for detection of the degree of liver fibrosis. Liver biopsy is an invasive and traumatic way for detecting liver diseases, in addition to the risks of serious complications. The inconsistency of results is an important problem in cases of liver biopsies due to sampling errors, intra-observer and inter-observer variabilities (³). Therefore, the development of non-invasive examination modalities is required (⁴).

One of these methods is the mechanical vibration-based elastography techniques which used a mechanical vibrator to induce shear waves into the body. This technique is implemented in a standalone clinical device: Fibroscan®. Transient elastography measures shear wave velocity and thus determines tissue stiffness by using ultrasound to follow the propagation of a low frequency shear wave generated in a tissue by an
external vibrator\textsuperscript{(5,6)}. Main limitations of FibroScan\textsuperscript{®} are the presence of ascites and obesity. Actually shear waves do not propagate through liquids. Thus, Fibroscan examination fails in some patients with ascites\textsuperscript{(7)}. In 2003 Wai et al.\textsuperscript{(8)} issued a study in which they validated a liver fibrosis index known as APRI score that founds a relationship between serum aspartate aminotransferase levels and platelets count.

APRI was simply calculated according to the following equation\textsuperscript{(9)}:

\[
\text{APRI Score} = \left( \frac{\text{AST of the sample}/ \text{reference AST} \times 100}{\text{platelets}} \right)
\]

In a meta-analysis of 40 studies, investigators concluded that an APRI score greater than 1.0 had a sensitivity of 76% and specificity of 72% for predicting cirrhosis. In addition, they concluded that APRI score greater than 0.7 had a sensitivity of 77% and specificity of 72% for predicting significant hepatic fibrosis\textsuperscript{(10)}. The APRI alone is likely not sufficiently sensitive to rule out significant disease. Some evidence suggested that the use of multiple indices in combination (such as APRI plus FibroTest) or an algorithmic approach may result in higher diagnostic accuracy than using APRI alone\textsuperscript{(11)}.

**Aim of the Study**

To assess the diagnostic accuracy of FibroScan\textsuperscript{®} and APRI score in detecting the degree of liver fibrosis in CHB patients with biopsy samples as a reference standard.

**Materials and Method**

**Patients:** In this cross-sectional study, 37 out of 44 patients with CHB, were selected (Three had been excluded due to their invalid liver biopsy results and four did not complete their TE study). All subject had been admitted to the Gastroenterology and hepatology hospital at Baghdad Medical City from February to June 2016. The diagnosis was made in accordance with guidelines for the prevention and treatment of CHB published by the American Association for the Study of Liver Disease (AASLD)\textsuperscript{(12)}. Written informed consents were obtained from all participants.

**Inclusion criteria\textsuperscript{(13,14)}**

- Age, 18-65 years, irrespective of gender.
- CHB of various degrees in association with liver fibrosis.
- History of abnormal transaminase.
- Provision of signed informed consent by the patient.

**Exclusion criteria\textsuperscript{(13,14)}**

- Unavailability of patient consent.
- Other complicated liver conditions, including other types of viral hepatitis, alcoholic and non-alcoholic fatty liver disease, autoimmune hepatitis and inherited metabolic liver disease.
- Hepatic decompensation, including the presence of ascites.
- Body mass index (BMI) $\geq 30$.
- Non-healed upper quadrant abdominal wound.
- Space-occupying tumours or cysts in the right lobe of the liver.
- Acute hepatitis or cholestatic hepatitis.
- Intake of medication known to affect liver enzymes within two months prior to biochemical blood analysis.
- Pregnancy.
- Obesity.

Approximately 5mL of whole blood (venous) were collected from each participant and sent to the hospital laboratories for CBC and liver function tests results. The HBsAg rapid tests done with fresh sera were performed within half hour after blood sampling. Serum HBsAg was measured in all specimens using enzyme immunoassays (EIAs; Abbott Laboratories, North Chicago, IL, USA). The serum HBsAg titer $\geq 0.05$ IU/mL was considered positive. AST to platelets ratio (APRI) was calculated according to the following equation\textsuperscript{(8,19)}:

\[
\text{APRI Score} = \left( \frac{\text{AST (IU/L)/AST (Upper limit of normal IU/L))}}{\text{Platelet (X10}^9\text{/L)}} \right)
\]

**Measurements of transient elastography (TE):**

This was done using FibroScan\textsuperscript{®} (FibroScan\textsuperscript{®}; EchoSens, Paris, France) under supervision of a trained operator. Patients were placed in the supine position with their right arm fully abducted. Measurements were taken from the area over the right lobe of the liver through the intercostal space. At least ten valid TE readings were
obtained for each patient and the median value was used for analysis. The results were expressed in kPa. Those cases with a success rate <60% were regarded as invalid (14).

**Liver histology.** Liver biopsies were obtained using Frankline-Silverman Biopsy needle, 16 G or 18 G (TEKNO-MEDICAL, optlk-Chirurgie GmbH & CO.KG). Liver biopsy specimens were fixed in formalin, embedded in paraffin and stained with hematoxylin and eosin, silver, Masson Trichrome staining and Sirius Red. Necro-inflammatory activity and liver fibrosis were scored according Metavir classification for liver fibrosis score (15).

**Table 1. Staging degree of fibrosis according to Metavir Score** (16,17)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>Portal fibrosis to be enlarged, localized peri-sinusoidal and intra-lobular fibrosis</td>
</tr>
<tr>
<td>2</td>
<td>Peri-portal fibrosis, several fibrous septa with lobule structure remaining</td>
</tr>
<tr>
<td>3</td>
<td>Numerous fibrous septa companied, Lobule structure distortion, without cirrhosis</td>
</tr>
<tr>
<td>4</td>
<td>Early cirrhosis</td>
</tr>
</tbody>
</table>

**Statistical Analysis**

SPSS 25.0, GraphPad Prism 7.0 software package used to make the statistical analysis, P value considered when appropriate to be significant if less than 0.05. Two samples Chi-Squared test was used to analyse the differences in stage of fibrosis between two groups (Liver biopsy and non-invasive Fibroscan groups).

**Results**

Out of 44 patients diagnosed as a case of CHB, 37 were involved in this cross-sectional study (Figure 4). The mean ±SD age for the involved sample was 34.11±12.20 years. Male participants were 19 (51.4%), while number of female patients was 18 (48.6%).

A total of 22 (59.4%) patients (as in table 2) who did liver biopsy had early stage fibrosis (F0-F1), nearly the same number 24 (64.8%) showed early stage of fibrosis by non-invasive method. In 12 (32.4%) patients, their fibrosis stage was F2 by liver histology, whereas 10 (27%) patients gave same stage of fibrosis by the non-invasive method. Comparing fibrosis stages between liver biopsy assessments with that of Fibroscan showed that there is a significant association between the two groups (P<0.005).

**Table 2: Comparison between the liver biopsy and liver stiffness results regarding the stage of fibrosis**

<table>
<thead>
<tr>
<th>Stage of fibrosis (Metavir)</th>
<th>Liver Biopsy</th>
<th>Fibroscan</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0-F1</td>
<td>22 (59.45%)</td>
<td>24 (64.86)</td>
</tr>
<tr>
<td>F2</td>
<td>12 (32.43 %)</td>
<td>10 (27.02)</td>
</tr>
<tr>
<td>F3</td>
<td>2 (5.4%)</td>
<td>1 (2.7%)</td>
</tr>
<tr>
<td>F4</td>
<td>1 (2.7%)</td>
<td>2 (5.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

Chi-Square 31.432 36.622  
P Value < 0.001

The mean (SD) APRI score for patients (N=22) with early degree (F0-F1) of liver fibrosis was 0.58 (0.417), while those with advanced fibrosis (F3) their APRI mean score was 0.49. on the other hand, out of 37 patients with CHB selected in this study, one patient showed end stage liver disease (cirrhotic) and the mean for APRI score was 1.4 (Table 3).

**Table 3: Statistical descriptive data of APRI and Fibroscan results as compared to liver biopsy**

<table>
<thead>
<tr>
<th>APRI</th>
<th>Liver Biopsy No.</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>95% Confidence Interval for Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td></td>
<td>F0-F1</td>
<td>22</td>
<td>0.5859</td>
<td>0.41787</td>
</tr>
<tr>
<td></td>
<td>F2</td>
<td>12</td>
<td>0.5625</td>
<td>0.23018</td>
</tr>
<tr>
<td></td>
<td>F3</td>
<td>2</td>
<td>0.6200</td>
<td>0.49497</td>
</tr>
<tr>
<td></td>
<td>F4</td>
<td>1</td>
<td>1.4000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>0.6022</td>
<td>0.37847</td>
<td>0.4760 0.7284</td>
</tr>
</tbody>
</table>
ANCOVA Test

Comparing the mean of APRI score results with those of liver histology showed no significant association between the two groups (P>0.005; Table 4). However, there was significant association between the non-invasive (Fibroscan) results with those of liver biopsy (histopathology) results (P<0.05; Table 4).

Table 4: Comparing mean APRI score and Fibroscan final results with liver biopsy (ANCOVA test)

<table>
<thead>
<tr>
<th></th>
<th>Liver Biopsy</th>
<th>Sum of Squares</th>
<th>Mean of Square</th>
<th>F</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>APRI</strong></td>
<td>Between Groups</td>
<td>0.662</td>
<td>0.221</td>
<td>1.620</td>
<td>0.204</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>4.495</td>
<td>0.136</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>5.157</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fibroscan</strong></td>
<td>Between Groups</td>
<td>7.236</td>
<td>2.412</td>
<td>4.972</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>Within Groups</td>
<td>16.008</td>
<td>0.485</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>23.243</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Discussion**

The use of non-invasive method for evaluation of liver fibrosis stage in chronic hepatitis B patients is a promising method for an accurate diagnosis and may replace the invasive liver biopsy (18-20).

Most of patients were referred to GIT centre after diagnosed with chronic hepatitis B infection accidentally during premarital screening protocol and prenatal maternal health care. Comparing the results of fibrosis stage between the liver biopsy assessment with that of the non-invasive method using the FibroScan® device, showed that (after assessment by utilization of Chi-squared and ANCOVA tests) there was significant association between the two groups (P<0.005). A previous study (13) involved 81 patients diagnosed with CHB and assessed the stage of liver fibrosis in those patients by using transient elastography, Acoustic Radiation Force Impulse and compared these results with liver histology done for the same group.

There was significant association between the stage of fibrosis and the results obtained using ARFI and FibroScan (Kruskal-Wallis; P<0.001), matching the same results to this study. Another study (2) in which Real-time elastography was performed in 55 patients with liver fibrosis and chronic hepatitis B and in 20 healthy volunteers, accuracy of real-time elastography for liver fibrosis staging was analysed. There was significant association in those with stage F0/F1, F2, F3 (Metavir score), but not significant for those with stage F4 (P>0.005).

In this study we did correlation between the two groups (FibroScan and liver histology) and the statistical method used found out the correlation as two major groups. We couldn’t apply the test for F3, and F4 group alone due to very limited number. In Wang et al. (2) study, they used a different statistical method to correlate between each group, and the result was significant for F0/F1, F2 and F3 groups, but not for F4 group. This may be explained by the small sample size regarding this group (6 out of 55 patients).

APRI Score was used as a non-invasive method for assessing the degree of liver fibrosis. It is calculated according to the formula proposed by (8), namely, 
\[\frac{\text{AST of the sample/ reference AST} \times 100}{\text{platelets}}\]

In our study, comparing the results of APRI score with that of fibrosis stage assessed by liver histology, there was no significant association found (P>0.05). A study done by (9), utilizing APRI score as an alternative to liver biopsy for treatment indication in chronic

...
hepatitis C, found that it has a satisfactory sensitivity and specificity together with a high predictive value in assessing the degree of liver fibrosis and can be used as an alternative to liver biopsy. The differences in the results can be explained by small sample size involved in our study (57), while (9) study involved 400 patients.

Another explanation is that our study included CHB patients, while the mentioned study included Hepatitis C Virus infected patients. This may be explained by the difference of viral activity and their effect on liver tissue and the pattern of hepatitis degree.

Studies have analyzed the performance of TE (13,18-20) although a number of these reports were heterogeneous, with small cohorts of patients and, in certain cases, without confirmation by liver biopsy. In this setting, (19) have proposed that a combination of liver stiffness evaluation (LSE) and blood tests for fibrosis may improve the diagnostic accuracy in patients with chronic hepatitis C. However, in a separate study (20), reported that a combination of LSE and blood test did not improve the accuracy with which cirrhosis was diagnosed. Whether the combination of TE and additional serological markers improves the diagnostic accuracy, thereby reducing the requirement for liver biopsy in patients with hepatitis B, has remained to be determined.

**Conclusion**

TE has reliable results in assessing the degree of liver fibrosis in CHB patients. Also, APRI score did not show a significant association with degree of fibrosis in CHB patients.

**Ethical Clearance:** The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding.

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Evaluation the Antimicrobial Efficacy of NaOCL-EDTA, MTAD and NaOCL- citric Acid Against Enterococcus faecalis in Root Canals of Primary Teeth (an in vitro study)

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Abstract

Background: The main etiology of pulp diseases and per-radicular lesion is presence of microorganisms. The disinfection phase of root canal therapy is fundamental determinant in complete healing of periapical tissue. The purpose of this study was to compare the antimicrobial efficacy of 3% NaOCL-17%EDTA, MTAD and 3% NaOCL-10% citric acid against Enterococcus faecalis. Method: This study utilized 45 human primary teeth with single root. The samples infected with E. faecalis for 2 days. Incubation all the infected samples in brain heart infusion broth (for 2 weeks). before irrigation procedure swaps from all the canals were taken and considered as controls. Post irrigation samples were taken after complete treatment. Evaluation the disinfection efficacy of three methods was done by cfu/ml to show the number of the remaining bacteria, statistical analysis was done using one way anova and post-hoc Dennett t3 test.

Result: All samples treated with 3% NaOCL- 17% treated with 3% NaOCL and 17% EDTA showed nearly complete absence of bacteria. The 15 samples treated with MTAD showed similar results to the first group, while the least antibacterial effect was seen in the 3% NaOCL-10% citric acid group. Statistical analysis of data showed highly significant difference between groups (P< 0.01). Conclusion: This study showed that both 3% NaOCL-17% EDTA and MTAD are effective against E. faecalis, while 3% NaOCL and 10% citric acid showed the least effectiveness.

Keywords: NaOCL, EDTA, MTAD, citric acid, Enterococcus faecalis. BHI.

Introduction

The main etiology of pulp diseases and per-radicular lesion is presence of microorganisms [¹]. The disinfection phase of root canal therapy is fundamental determinant in complete healing of periapical tissue [²]. However, chemo mechanical preparation of root canal system and using of antimicrobial agent is very effective in the elimination of microorganisms [³]. There are many facultative microorganisms which are persistently detected in failure root canal treatment and the most common one is Enterococcus faecalis [⁴]. It has been showed that microorganisms presented in root canals of primary teeth and in permanent teeth root canals are similar [⁵].

Though NaOCL is an effective root canal irrigating solution, it has several disadvantages such as unpleasant odor and bad taste as well as NaOCL can cause irritation and tissue toxicity when extruded in per-radicular tissue [⁶].

In 2003, [⁷] created a new irrigant material called (MTAD), it was a mixture of 3% doxycycline, 4.25% citric acid and detergent (tween 80), which is able to smear layer removal [⁷] and effective in elimination of E. faecalis from root canal [⁸].

Effective cleaning of root canal requires the use of both organic and inorganic tissue- dissolving agents. Using of demineralizing agents such adjunct solutions in endodontic treatment is recommended. In 1957,
recommended the use of chelating agent to aid in preparation of calcified and narrow canal. EDTA (17%) is most commonly used as neutralized solution. The reaction between EDTA and calcium of dentin form soluble calcium chelates. Decalcification process of EDTA is self-limiting that would stop eventually because of lacking the chelator \[10\]. Concentration of citric acid ranged from 1% to 50%. Use of 10% citric acid as a final irrigating solution is very effective in smear layer removal \[11\].

The present study was aimed to compare the antibacterial efficacy of 3% NaOCl-17% EDTA, MTAD and 3% NaOCl-10% citric acid irrigating solutions in primary teeth root canals infected with *E. faecalis*.

**Material and method**

Forty five extracted single rooted human primary teeth were collected from children aged 6-7 years (Tow third of the root length at least should be preserved). Crowns of teeth were cut leaving only the roots. Determination of working length is completed radiographically. Instrumentation of the roots to size 30 K-type file. Then cleaning the samples with normal saline and sterilized by autoclave at for 30 minute at 121 c with 15 IB \[12\].

*E. faecalis* isolated from infected root canals. Several samples were taken from chronic infected roots that suspected to be inhabitant with *E. faecalis*. Bile esculin test (selective test for *E. faecalis*) was used for first identification of bacteria(Figure 1) where black deposit appears after 24 hours of samples culturing, then *E. faecalis* further detecting by vitek2 system for more accuracy

The colony of *E. faecalis* suspended in normal saline then the sterilized tooth specimens were inoculated with *E. faecalis* that was cultured in Brain-Heart Infusion (BHI) broth at 37°C for 18 hours in an atmosphere of 5% CO\(_2\), using 30 gage needle to inject the broth suspension inside root canal. Specimens of teeth were immersed in broth at 37°C to allow bacterial growth. The medium was changed once a week for each 4 consecutive weeks. Four weeks’ period was chosen for inoculation of bacteria as recognizable number of bacterial colonies has been produced after it. After that, teeth were removed from the bacterial culture and covering the root apices with Cavit™. Each tooth specimen end was wiped with 3% sodium hypochlorite for disinfection of the outside of the tooth before irrigation treatment \[13\].

The samples were randomly divided into 3 groups for experimental procedure of irrigation materials. Sterile paper point that used for taking swap from root canal (pre samples) before irrigation procedures. Before each irrigation procedure the root canal irrigated with normal saline and preoperative swap was taken, normal saline here acts as media for inoculation of the content of canal.

**Irrigation procedure**

Group 1: 15 roots samples in this group, each root canal is irrigated firstly with 2ml 3% NaOCl then normal saline cleaning followed by irrigation with 17% EDTA and final irrigation with normal saline.

Group 2: 15 samples of this group irrigated with MTAD, 2ml of MTAD used for root canal irrigation followed by irrigation with normal saline.

Group 3: 15 roots samples in this group, each root canal irrigated with 2ml of 3% NaOCl and normal saline irrigation thereafter, irrigation with 10% of citric acid followed by final irrigation with normal saline.

Sterile paper point used for taking post irrigation procedure from the root canal. Both pre and post sample were kept in Eppendorf tubes which contain 1ml of normal saline (Figure 2) and transferred to the laboratory for serial dilution and bacterial count by using cfu/ml procedure (Figure 3)
Results

Table (1) Descriptive statistical values of antibacterial effect of the three irrigation methods used in the study

There is reduction in the number of bacterial colonies in all three irrigation regimens (Table 1).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTAD</td>
<td>98.037</td>
<td>1.029</td>
<td>95.45</td>
<td>100.00</td>
</tr>
<tr>
<td>NAOCL&amp;EDTA</td>
<td>99.187</td>
<td>1.975</td>
<td>94.00</td>
<td>100.00</td>
</tr>
<tr>
<td>NAOCL&amp;CITRIC ACID</td>
<td>74.481</td>
<td>5.602</td>
<td>63.51</td>
<td>84.21</td>
</tr>
</tbody>
</table>

Results of one way ANOVA revealed that there is significant difference between antibacterial efficacy of three groups P=.000 which is less than 0.01 (Table 2).

Table 2 Descriptive statistical values of one way ANOVA analysis of the three Groups

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean of Squares</th>
<th>F</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>5832.821</td>
<td>2</td>
<td>2916.410</td>
<td>240.724</td>
<td>.000 [HS]</td>
</tr>
<tr>
<td>Within Groups</td>
<td>508.837</td>
<td>42</td>
<td>12.115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6341.658</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Levene statistics=17.993, df=2, p value=0.000[HS].
Table 3 Multiple comparisons between the antibacterial effect of the three irrigation methods by Dunnett t3 post hoc test

<table>
<thead>
<tr>
<th>(I) Group</th>
<th>(J) Group</th>
<th>Mean Difference (I-J)</th>
<th>Significance</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>MTAD</td>
<td>NaOCL &amp; EDTA</td>
<td>-1.151</td>
<td>.161 [NS]</td>
<td>-2.636</td>
</tr>
<tr>
<td></td>
<td>NaOCL &amp; citric acid</td>
<td>23.555</td>
<td>.000 [HS]</td>
<td>19.628</td>
</tr>
<tr>
<td>NAOCL&amp;EDTA</td>
<td>NaOCL &amp; citric acid</td>
<td>24.706</td>
<td>.000 [HS]</td>
<td>20.677</td>
</tr>
</tbody>
</table>

Multiple comparisons between groups showed there is no significant difference between MTAD and 3% NaOCL – 17% EDTA group, the P value = 0.161 (P>0.05). High significant difference between MTAD and 3% NaOCL-10% citric acid the P value is .000, comparison between 3% NaOCL-17% EDTA and 3% NaOCL-10% citric acid showed high significant difference P<0.01 (Table 3).

Table 4 The paired samples statistics of effect size (antibacterial effect) for pre and post samples for all groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Paired Samples Statistics</th>
<th>T value</th>
<th>P value</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRE</td>
<td>Post</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean SD</td>
<td>Mean SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTAD</td>
<td>3.675 1.251</td>
<td>.067 .032</td>
<td>11.202</td>
<td>.000 [HS] 2.892</td>
</tr>
<tr>
<td>NaOCL &amp; EDTA</td>
<td>2.041 .626</td>
<td>.014 .034</td>
<td>12.394</td>
<td>.000 [HS] 3.200</td>
</tr>
<tr>
<td>NaOCL &amp; citrus acid</td>
<td>3.044 1.115</td>
<td>.762 .293</td>
<td>9.891</td>
<td>.000 [HS] 2.554</td>
</tr>
</tbody>
</table>

Df=14 Table (4) showed the reduction in the means percentage of the post samples of bacterial colonies for all three methods, but the largest effect size is 3.200 in the (3% NaOCL-17% EDTA) group, followed by MTAD group with 2.892 effect size, while the least effect size is 2.554 in the (3% NaOCL-10% citric acid) group (Table3).

Discussion

Root canal treatment aimed for complete elimination of bacteria, their byproducts and bacterial substrate of root canal system [14]. Utilization of irrigation agent in this procedure is fundamental to ensure elimination of bacteria and remnant of organic tissue [15]. Maximum antimicrobial activity, maximum dissolution ability on the necrotic tissue with least toxic irritation on periapical tissue are some of essential requirement of an ideal irrigation solution [16]. The successful of chemo mechanical procedures root canal treatment is adversely effected by complex anatomic structures and large irregularities of root canals system deciduous teeth [17]. The antibacterial action of NaOCL is by releasing hypochlorous acid (HOCL) and its oxidation effect on the sulfhydryl group of bacterial enzyme resulted in disruption of the metabolic process of bacteria [18]. Extrusion of NaOCL per apically resulted in toxic
effect to per radicular tissue. In endodontic treatment of deciduous teeth, NaOCL can cause damage to the follicles of permanent teeth, per radicular tissue and oral mucosa. After introduction of MTAD by Torabinijad in 2003, various test procedures evaluated the antimicrobial effect of MTAD and many researches compared its effect with most common irrigation solutions. E. faecalis is the most common bacteria isolated from endodontic cases with periapical lesion. For that reason, it was selected in this study. Several previous in vitro studies have been showed that E. faecalis is highly susceptible to MTAD, even when irrigation solution was diluted 200 times. On the other hand, sodium hypochlorite beyond 32 times dilution loses its antibacterial activity against the same isolated bacteria. MTAD is able to effectively remove smear layer with significantly lower erosion effect in dentinal tubules in comparison with EDTA. MTAD is a biocompatible material. It is less cytotoxic than 3% H2O2, Eugenol, Ca(OH) paste, 5.25% NaOCL, 0.12 chlorhexidine gluconate and EDTA. The antimicrobial activity of MTAD is by anti-collagenase activity of doxycycline, its low pH (2.15) ability to sustained release over period of time.

Third ingredient tween 80 sorbitol helps in reducing the surface tension on solution to allow doxycycline penetrates deeper into the dentinal tubules. It has been found that MTAD inhibits the growth of most E. faecalis strain after dilution 1:8192 times and when diluted 1:512 times able to kill most strain of E. faecalis. In this study MTAD showed similar effect to 3% NaOCL-17% EDTA. Statistical analysis of data showed that there is no significant difference between two groups P value is .161 (which is >0.05). The results of this study were in accordance with. However, the results were disagreeing with. Our results revealed that 3% NaOCL-10 citric acid had least antibacterial efficacy among the three groups with the mean percentage of 74.481. NaOCL is an effective antimicrobial solution, however it has little effect on smear layer removal. Citric acid is a chelating agent used as a final irrigant for smear layer removal. Many bacterial colonies are present in smear layer. Incomplete removal of smear layer is attributed to the presence of bacterial colonies in the post irrigation samples and reduce the efficacy of 3% NaOCL-10% citric acid group. Our finding is in accordance with. Combination of NaOCL-EDTA is the most effective irrigation method for smear layer removal. However, results of this study disagreed with who found that citric acid is more effective than 17% EDTA and MTAD in smear layer removal. This disagreement was because a high concentration of citric acid used in his study which is 42%. On the other hand, concluded that 17% EDTA was significantly more effective than 20% citric acid in smear layer removal. The disparity in the results may be caused by differences in methods and procedures or may be variance in bacterial strains tested. Inappropriate following of manufacture’s recommendations may also affect the results.

Ethical Clearance: The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding.

Reference


15. Kuruvilla JR, Kamath MP. Antimicrobial activity of 2.5% sodium hypochlorite and 0.2% chlorhexidine gluconate separately and combined, as endodontic irrigants. J Endod 1998; 24(7): 472-476.


28. O’Connell MS, Morgan LA, Beeler WJ, Baumgartner JC. A comparative study of smear


Isolation and Identification of *Prevotella Intermedia* by Culture and Polymerase Chain Reaction

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¹B.Sc. Veterinary Medicine and Surgery, ²Medical Microbiology Department, ³Operative Dentistry Department, College of Dentistry, Babylon University, Babylon Province

Abstract

Background: Endodontic disease is the result of both the pathogenic effects of the microbes and response of the host. The most common species isolated from primary endodontic infections are black pigmented bacteria. These bacteria are obligate anaerobes, non-motile and non-spore forming, which are oxygen sensitive organisms. These organisms are implicated in apical abscess formation due to their proteolytic activity. *Prevotella* species such as *Pr. intermedia* have been cultured from 26‒40% of infected root canals, suggesting an association with proteolytic activity of the isolated bacteria from clinical samples are difficult in growth supplies, it may give flexible effects with obtainable biochemical test, so it is not all the time detected or might be misidentified during the detection. The 16SrRNA gene has brought an original instrument for approximating bacterial phylogeny. The Aim of this study was to investigate the presence of Black-Pigmented Bacteria, *Pr. Intermedia* in Endodontic Infections By Culture Method And Polymerase Chain Reaction (PCR) Analyses; Also Detection Biochemical, Virulence Potential of microbial isolate and examine the antibiotic sensitivity test to isolated bacteria. Methods: The study population contained of thirteen patients, ages ranged from nineteen to fifty five years awarding at the endodontic unit in the Dentistry College of the University of Babylon. Ten isolates (33.3%) of *Pr. intermedia* were reported as positive by 16SrRNA gene whereas only six isolates (20%) reported positive results by traditional culture and biochemical test. Results: All isolates showed positive results for several virulence factors. Of the selection six antibacterial drugs evaluated against all the Bacterial isolate: amoxicillin, Augmentin and penicillin G were highly effective in terms of maximum diameter of growth inhibition zones. Clindamycin and Erythromycin were found to be moderately effective against the isolated bacteria. Metronidazole was not effective against the bacteria as it did not show any inhibitory activity. Conclusions: The presence of *Pr. intermedia* suggests that a significant role is played by these organisms in the pathogenesis of Endodontic infections. Furthermore, PCR provided more frequently detected endodontic Black pigmented bacteria than did culture. All isolates capable to produce biofilm, gingpine and ability to adherence. Based on the study results, amoxicillin-clavulanic acid and amoxicillin were the most potent antibiotics most antimicrobial agents in vitro, against *Pr. intermedia* isolated from root canal infection, therefore can be used treatment root canal infection.

Keywords: Endodontic disease, Pr. intermedia, 16S RNA gene, PCR, biofilm.

Introduction

Endodontics is branch of dentistry that deals with the etiology; diagnosis; treatment and prevention of the disease of the pulp and periapical tissue compatible with good health. Endodontic disease is the result of both the response of the host and the pathogenic effect of microbes. Infection of endodontic origin is very common in the general inhabitants. They are primarily characterized by the presence of harmful agent and a complex immune system that function by the neutralization of bacteria and induction of tissue repair. Dental caries is the most common route of entry microorganism; other path ways for pulp infection include dentinal cracks; trauma; exposed dentinal tubules or the main apical foramen. Strict
anaerobic bacteria especially black pigmented bacteria is gram negative rod are implicated in the development of acute periradicular inflammation, producing symptoms such as pain; swelling; tenderness and exudation (5). These bacteria are obligate anaerobes, non-motile and non-spore forming which are fastidious and oxygen sensitive. Prevotella spp such as pr. intermedia and pr. nigrescens have been cultured from 26-40% of infected pulp infection, suggestion with proteolytic activity (6). Pr. intermedia whose habitat is the strict anaerobic environment of the Gingival crevice, gastrointestinal tract and is found as component of the resident microflora of these sites in humans and the animals (7). Pathogenicity of bacteria is mainly related to the presence of lipopolysaccharides and peptidoglycans. They induce hormones like cytokines which play an important role in inflammation, stimulate B-lymphocytes, activate complement cascade, release various enzymes like collagenase, and enhance production of various pain mediators like bradykinin, histamine and prostaglandins; lipopolysaccharides (LPS) once released (as endotoxin) cause biological effects, including inflammation and bone resorption (8). Techniques using 16S rRNA gene sequence data have been developed intended for usage in the field of microbial ecology to assess the members of different microbial communities containing uncultivable microorganisms (9). The Aim of this study was to investigate the presence of Black-Pigmented Bacteria, Pr. Intermedia in Endodontic Infections By Culture Method And Polymerase Chain Reaction (PCR) Analyses; Also Detection Biochemical, Virulence Potential of microbial isolate and examine the antibiotic sensitivity test to isolated bacteria.

Materials and Method

Samples: The study population involved thirty patients, ages extended from nineteen to fifty-five years (Mean ± SD: 33.4 ± 12.3 years). Awarding at the Endodontic unit in the Dentistry College of the University of Babylon, excluded patients who had systemic disease and taken antibiotic within the last three months. All patients signed an informed consent.

Bacterial procreation and isolation: Samples collected from patients with endodontically teeth treatment by inserting two paper points for about 15 second for each patient then transferred to the sterile tube contain brain heart infusion broth then to the lab of microbiology, after that the samples collected separated; one put in incubated anaerobic directly and cultured for about 7-14 days in the selective media (ATCC 2722) (10) and two samples incubated also in anaerobic incubator which contained brain heart infusion broth were used for extracted DNA by PCR technique with specific primer. Isolation and all biochemical tests for diagnosis of Pr. intermedia was done according to (11, 12).

PCR Analysis

DNA extraction from samples was done using Favorgen/Taiwn according to manufacturing instruction (table 1). To detect the presence of Pr. intermedia, primer pairs targeted to the 16S mRNA gene which used according to (13). Then products of PCR were analyzed by 2% agarose gel electrophoresis in TBE buffer at (100 V for 2hrs). Then stained gels with Ethidium bromide (0.5 lg/ml) and PCR products were envisaged under Ultra Violet light to individuality of each band was inferred by judgment with a molecular weight ladder: Primers (Pr.intermedia); Sequences (F/5’- CGTGGACCAAAGATTCCGTCG-3’; R/3’- CTTACTCCCCAAGCAAGCA-5’; Amplicon size pb (256 bp)) (13)

| Table (1) PCR cycle for P. intermedia
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps</td>
<td>Temperature</td>
<td>Time</td>
<td>No. of cycles</td>
</tr>
<tr>
<td>Initial denaturation</td>
<td>95</td>
<td>30 sec</td>
<td>1</td>
</tr>
<tr>
<td>Denaturation</td>
<td>95</td>
<td>30 sec</td>
<td></td>
</tr>
<tr>
<td>Annealing</td>
<td>58</td>
<td>45 sec</td>
<td>35</td>
</tr>
<tr>
<td>Extension</td>
<td>72</td>
<td>20 sec</td>
<td></td>
</tr>
<tr>
<td>Final extension</td>
<td>72</td>
<td>5 min</td>
<td>1</td>
</tr>
</tbody>
</table>

The reaction mixture reaction

Amplification of DNA was carried out in a final volume of 20μl reaction mixture as mentioned in table (2).

| Table (2) Contents of the reaction mixture
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Contents of reaction mixture</td>
<td>Volume</td>
</tr>
<tr>
<td>1.</td>
<td>Green master mix</td>
<td>10μl</td>
</tr>
<tr>
<td>2.</td>
<td>Upstream primer</td>
<td>1μl</td>
</tr>
<tr>
<td>3.</td>
<td>Downstream primer</td>
<td>1μl</td>
</tr>
<tr>
<td>4.</td>
<td>DNA template</td>
<td>2μl</td>
</tr>
<tr>
<td>5.</td>
<td>Nuclease free water</td>
<td>6μl</td>
</tr>
<tr>
<td>Total volume</td>
<td></td>
<td>20 μl</td>
</tr>
</tbody>
</table>
Antibiotic sensitivity test

The antimicrobial sensitivity of the test isolate of bacteria by using 6 antibacterial drugs was determined by Kirby-Bauer disc diffusion method (14, 15). The antibiotics susceptibilities of the isolates were determined according to Clinical and Laboratory Standards Institute’s guidelines National Committee for Clinical Laboratory Standards 2017 (CLSI 2017).

Result

Prevalence of positive isolates (Pr. intermedia) from culture and molecular methods

From total thirty samples of patients with endodontic treatment, six isolates (20%) of Pr. intermedia were reported as positive by molecular detection, whereas only ten isolates (33.3%) reported positive by culture and biochemical procedures.

Table 3: General characteristic of isolated P. Intermedia

<table>
<thead>
<tr>
<th>Biochemical characteristics</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth on selective media</td>
<td>Black to brown pigment on selective media</td>
</tr>
<tr>
<td>Requirement of Hemin and vit K</td>
<td>+</td>
</tr>
<tr>
<td>Gram stain reaction and shape on microscope examination</td>
<td>Gram negative; rod</td>
</tr>
<tr>
<td>Catalase</td>
<td>_</td>
</tr>
<tr>
<td>Indol</td>
<td>+</td>
</tr>
<tr>
<td>Citrat</td>
<td>_</td>
</tr>
<tr>
<td>Urease</td>
<td>_</td>
</tr>
<tr>
<td>Motility</td>
<td>_</td>
</tr>
<tr>
<td>Fermentation glucose</td>
<td>+</td>
</tr>
</tbody>
</table>

In Table (3) identification of Pr. intermedia by cultivation in anaerobic condition in selective media supplemented with (Trpticase, Hemin, vit K, L-cystein hydrochloride, yeast extract) then proofed by biochemical test which included Catalase; Indol; Citrat; Urease; Motlity test; Fermentation. These was helped in demonstration of six isolates (20%) that appeared clearly.

Table 4: Virulence factor of isolated bacteria

<table>
<thead>
<tr>
<th>Virulence factor</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence</td>
<td>+</td>
</tr>
<tr>
<td>Biofilm</td>
<td>+</td>
</tr>
<tr>
<td>Vancomycin sensitivity test</td>
<td>+(Resistance)</td>
</tr>
<tr>
<td>Gingipain production</td>
<td>+</td>
</tr>
</tbody>
</table>

In table 4: confirmed the virulence factor for all sample of P. intermedia that documented by culture seem that biofilm production, adherence ability, gingipain and vancomycin sensitivity test were found in all positively P.intermedia.
Figure (1) A. Pr. intermedia on selective media, B. Vancomycin resistance of Pr. Intermedi and C. Giemsa stained HeLa cells infected bacterial strains of pr.intermedia (i.e. exhibiting adherence patterns)

Figure (2): Amplified Pr. Intermedia gene DNA fragments on 2% agarose gel at 100volt for 2hr visualized under UV after staining with sayfe dye: Lane (L): DNA Ladder 256bp ladder. Lanes: 6,7,8,10,12,23,24,28,29,30 isolates of Pr. Intermedia show positive results.

Figure (2): Amplified Pr. Intermedia gene DNA fragments on 2% agarose gel at 100volt for 2hr visualized under UV after staining with sayfe dye: Lane (L): DNA Ladder 256bp ladder. Lanes: 6,7,8,10,12,23,24,28,29,30 isolates of Pr. Intermedia show positive results.
The antibiotics susceptibilities of the isolates were determined according to Clinical and Laboratory Standards Institute’s guidelines National Committee for Clinical Laboratory Standards 2017. *Pr. intermedia* showed this result that illustrate 100% sensitive to (AMC,AX); 83% sensitive to (P); 67% to (DA); 50% to (E); 17% sensitive to (M).

**Discussion**

Microorganisms that are able to invade the pulp tissue and survive in a root canal system are the causative pathogens in primary endodontic infections. The bacteria remaining in the root canal system after endodontic treatment cause secondary, or persistent, infections (16). The objective of this study was to compare between standard culture techniques and 16S rRNA PCR for detection of bacteria in root canals with endodontic infection. In this present study, the Black pigmented species studied were recovered from 13% and 50% of the root canals examined by culture and PCR analyses, respectively. *Pr. intermedia* is the most commonly found pigmented species, species in necrotic teeth (17) *Prevotella* spp are strictly anaerobic organisms and commonly isolated from human oral and extra-oral infections (18).

From culture and molecular methods: From total thirty samples of patients with Endodontic treatment, ten isolates (33.3%) of *P. intermedia* were reported as positive by molecular detection whereas only six isolates (20%) reported positive results by culture and biochemical procedures; this result agreement nearly with (19) that indicated PCR-based identification also showed higher detection rates of *Pr. intermedia* (33%) than culture (13%).

Identification of *Pr. intermedia* by culture in anaerobic condition in media supplemented with (tripticase, yeast extract, Hemin, and Vit K,L-Cystein hydrochloride) then proofed by biochemical test which included (Indole, catalase test, pigment produce) these was helped in demonstration of seven isolates (20%) that appear nearly agreement with this study (20) *Pr. Intermedia* have been studied intensively for their virulence properties in vitro. Biofilm formation in root canals is probably initiated sometime after the first invasion of the pulp cavity by planktonic oral microorganisms after some tissue breakdown (21). The major benefit of biofilm is security from detrimental factors such as the factors of host protection as well as antimicrobial substances including antibiotics (22); these appear in some isolation of *Pr. Intermedia* as show in Table (3) that show biofilm production; that agreement with this study indicated (23) all isolate exhibited biofilm-forming capacity. The observed adherence patterns were very diverse, that also agreement with study (23). Regarding the ability of the *Pr. intermedia* to adhere (pattern of the adherence being the diffuse). Gingipain is actually vital in virulence factors in the infection and functions related to cell host colonization and invasion that serve many roles for the microorganism, which donated to the survival and virulence (24). In Table (3)
all isolates showed positive results for gingipain these related with other study (24). All isolates of Pr. intermedia in culture showed resistance to vancomycin that similarity to this study also show all the isolates of Pr. Intermedia resistance to vancomycin (26).

All positive cultures in this study were tested for susceptibilities to antibiotics with the intention of determining the most effective drug for all isolated microorganisms. Most of the antibiotics employed in this study are commonly prescribed by dentists (27). The goal of the treatment of root canal infection is to control the spread of infection and provide symptom relief, which can usually be achieved without the use of antibiotics and other antimicrobial agents. Therefore, all bacterial isolates in this study were tested for susceptibilities to antibiotics; therefore, antibacterial activity of 6 commercial drugs was assayed by Kirby-Bauer disc diffusion method and data on the diameter of inhibition zones produced in the Pr. intermedia is presented in Figure (3); that indicated all clinical isolates had 100% sensitivity to Amoxicillin and Augmentin, 50% sensitive to Erythromycin, 67% sensitive to Clindamycin, 17% sensitive to metranidazol, 83% sensitivity to pencillin. This result nearly agreement with (28), but contrast to studies (29) that have shown the presence of change in susceptibility patterns; sensitive to pencillin 33%; AMC 100%; DA 100%; MET 66.7%.

Conclusion

The presence of Pr. intermedia suggests that a significant role is played by these organisms in the pathogenesis of Endodontic infections. Furthermore, PCR provided more frequently detected endodontic Black pigmented bacteria than did culture. All isolates capable to produce biofilm, gingipine and ability to adherence. Based on the study results, amoxicillin-clavulanic acid and amoxicillin were the most potent antibiotics most antimicrobial agents in vitro, against Pr. intermedia isolated from root canal infection, therefore can be used treatment root canal infection.

Ethical Clearance: The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

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Isolation of CD34+ Human Melanocyte Stem Cells from Hair Follicles

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Abstract

Background: Melanocytes are specialized neural crest-derived cells. They are responsible for hair, skin and eye pigmentation, so they are specialized pigment-producing cells. Melanoblasts are localized in the bulge region of the hair follicle can transform into melanocyte stem cells (MelSCs) or differentiated melanocytes, which produce melanin pigment. It holds promise for functional therapeutic potential and development for the future cell-based therapy of various diseases caused by defective pigment cells like vitiligo. The aim of this study was to isolate melanocyte stem cells from human hair follicle. Methods: The MelSCs CD34+ population was isolated by MagCellect Magnet and assessed for melanocyte stem cell markers by flow cytometry. Results: Results revealed that the isolated CD34+ melanocyte stem cells exhibited higher expression for melanocyte stem cells markers dopachrome tautomerase (DCT) and microphthalmia associated transcription factor (MITF) and differentiation markers melanocytic antigen (PNL2) and tyrosinase (TYR). Conclusion: the study revealed an efficient method of isolation of melanocyte stem cells. The cells were confirmed for their characteristics by flow cytometry analysis of positive and negative markers. Functional analyses of the isolated cells would further confirm its usage in cellular therapies for treatment of skin pigmentation disorders.

Key words: Melanocytes, stem cells, Mesenchymal cells, MelSCs CD34+, flow cytometry.

Introduction

Mesenchymal Stem Cells (MSCs) isolated from various adult tissue sources has gathered the attention of the scientific fraternity because of their potential to differentiate into multiple cell lineages viz., osteogenic, adipogenic, and chondrogenic lineages [1,2]. Besides, the relative ease of isolation, lack of immunogenicity, proliferative capacity and ethical acceptance have driven the surge of MSCs towards therapeutic applications [3,5]. Although bone marrow was considered the primary source of MSCs, recent reports have suggested several other sources including adipose tissue [6,7], peripheral blood [8], dental pulp [9], umbilical cord [10], placenta [11], endometrium [12], synovium [13] and skin [4,14]. However, despite similar phenotypic traits, MSCs from different sources differ in their genetic profile, differentiation potential and immunomodulatory properties [15,17]. For this reason, isolation and characterization of MSCs from novel sources is critical. One of the novel sources of MSCs that is being much studied is the skin, whose outer epidermal layer consists of two major cell types: melanocytes and keratinocytes [18]. The repopulation of melanocytes in the epidermis is attributed to the presence of a unique stem cell population, called the melanocyte stem cells (MelSCs) which are a class of somatic stem cell population that play an indispensable role in every cycle of hair pigmentation [19]. They replenish the hair-pigmentary unit during each hair cycle [20]. The alteration of MelSCs has been implicated in hair graying due to aging [21] and other skin diseases [18]. Nishimura et al. [20] first demonstrated the capacity of hair follicles to serve as a melanocyte stem cell niche. A mini-organ divided into the transit portion and the upper portion, the hair follicle harbors stem cells and supporting cells. While the transit portion regenerates along the hair cycle [22], the upper portion remains permanent and harbors epithelial

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stem cells \(^{[23]}\) and other supporting cells that express extracellular matrix and adhesion molecules essential for stem cell maintenance \(^{[242]}\). Also, Poblet et al. \(^{[25]}\) reported CD34 expression in human hair follicles, especially in the outer root sheath cells of anagen follicles. Stromal cells isolated from various tissues including adipose tissue have been reported to express CD34 \(^{[26]}\). Till date, markers that are exclusive for MelSCs have not been specified and therefore current identification method is heavily dependent on the localization of these cells in the bulge area of the hair follicle \(^{[19]}\). In this study we report the isolation and characterization of CD34+ melanocyte stem cells from hair follicles.

**Materials and Method**

Isolation and primary culture of Mel SCs from hair follicles

Fresh adult human scalp skin was collected by facelift procedure and washed with PBS containing 1X Penicillin-Streptomycin. The tissue was shredded into small pieces of about 1cm and was treated with DMEM (Life Technologies, USA) that contained 10mg/ml of Dispase (Sigma Aldrich, USA) at 4°C overnight. The enzymatically disaggregated skin was placed in a sterile Petri dish and hair follicles were pulled off by grasping the hair shaft near the skin and pulling firmly. The isolated follicle fragments were incubated in 0.05% Trypsin-EDTA (Invitrogen, USA) for 15-20min at room temperature with intermittent shaking. Trypsin was then inactivated by adding 4ml of DMEM (Life Technologies, USA) with 10% FBS and filtered through 40μm filter to obtain a single-cell suspension containing cells. The cells were centrifuged at 200g for 5min and the pellet was re-suspended in 1ml PBS containing 2% FBS (Life Technologies, USA). The cell suspension was cultured in DMEM with 20% FBS (Life Technologies, USA) in humidified incubator at 37°C with 5% CO\(_2\). Old media changed 3 times a week till the cultures reached 80 - 100% confluence.

Isolation of CD34 positive cells by Magcellect technology

Single-cell suspension of hair follicles was obtained by trypsinization. The cell suspension with a cell density of 10 x 10\(^6\) cells/0.5ml in cold 1X MagCellect Plus Buffer was labeled with biotinylated antibodies against CD34 (PE-conjugated) for 15min at 2-8°C. The cells were then centrifuged at 1600rpm at room temperature for 10min. The cell pellet was resuspended with 1mL cold 1X MagCellect Buffer (R&D Biosystems, USA). One hundred μL of streptavidin ferrofluid was added to the cell suspension, mixed gently and incubated at 2-8°C for 15 minutes. The cells were again washed with ice cold 1X MagCellect Buffer and centrifuged at 300g for 8min. The cell pellet was resuspended in 2mL cold 1X MagCellect Buffer. The reaction tube was placed in the MagCellect Magnet and was incubated for 6min at room temperature. The magnetically selected (CD34+) cells were collected and resuspended in 2mL of cold 1X MagCellect Buffer. These were cultured and expanded in DMEM with 10% FBS.

Characterization of melanocyte stem cells by flow cytometry

The expression of melanocyte stem cell markers DCT and MITF and melanocyte differentiation markers PNL2 and TYR was analyzed by flow cytometry. The cells isolated by Magcellect washed with PBS (300g at 25°C for 5min), fixed and permeabilized with ice-cold 70% ethanol at -20°C for 1h. For DCT, MITF and PNL2 markers the cells were treated with primary antibody for 30min in dark and then with the respective secondary antibodies labeled with PE for 30min in the dark. Conjugated antibodies (Tyr - PE) were added directly to the cells post ethanol fixation and incubated for 30min in the dark at room temperature. To study the expression of the surface marker (CD34-PE), primary antibody was added to the cells without ethanol fixation and incubated for 30min in the dark at room temperature. At the end of incubation, cells were washed with 1X PBS with 0.1% sodium azide. The cell suspension was analyzed by BD FACSCalibur (BD Biosciences, USA) and data were analyzed with CellQuest pro software.

**Results**

Morphological features of cultured human hair follicle cells

Morphological features of the cultured human hair follicle cells using our protocol were similar to those of the hair follicle cell cultures using the commonly used method. On Day 1, most of the cells were still mononuclear cells (Fig. 1a). On Day 2, some spindle-shaped cells appeared among the mononuclear cells (Fig. 1b). On Days 3 and 4, the number of spindle-shaped cells continued increasing (Fig. 1c). On Day 5, the spindle-shaped cells reached about 50–60% confluence.
(Fig. 1d), the cell growth was faster and on Day 7, the spindle-shaped cells reached 80% confluence and used for subculturing (Fig. 1f). The cells were passaged and used for CD34 positive cell isolation and enrichment.

On Day 1 (a) and 2 (b), most of the cells were still mononuclear. On Day 3 (c) and Day 4(d) some spindle-shaped cells appeared among the mononuclear cells. On Day 5(e) the numbers of spindle-shaped cells continued increasing. On Day 7 (f) the spindle-shaped cells reached about 80% confluence and the cells were passaged on this day.

The CD 34+ cells expressed melanocyte markers

The harvested cells were cultured and maintained in DMEM with 10% FBS. The non-adherent cells were eventually removed by medium changes. The remaining cells have spindle shaped, fibroblast-like appearance as shown in Figure 1. The MSC culture exhibited increased proliferation, which then resulted in maintaining homogeneous fibroblastic morphology. For further confirmation that the isolated stem cell population was melanocyte producing, the expression of melanocyte markers MITF and DCT were assessed. Flow Cytometry data showed that the isolated cells indeed gave positive higher expression for MITF and DCT with (89.07 and 89.56) %, respectively, (Figure 2 A and B).

The cells were also assessed for the expression of differentiation markers – PNL2 and TYR. This was to confirm that the cells were indeed stem cells and not differentiated cells. Flow Cytometry data indicated that the isolated cells failed to express PNL2 and TYR, thus suggesting that they were indeed stem cells. The cells gave mild expression for PNL2 (7.04%) and for TYR (7.05%). Figure 2 A showed the results of PNL2 and TYR expression in CD34+ melanocyte cells.

Figure 2. A. Flow cytometry of CD34 (pink) TYR (purple) MITF (yellow) and PNL2 (black) with Anti-mouse IgG (red) isotype as a control. Melanocyte differentiation markers PNL2 and TYR found to be negative and the cells were found to be positive for CD34, and melanocyte stem cell marker DCT was also found to be expressed in the cells. B. Flow cytometry analysis of DCT (green) with anti-rabbit IgG (purple) isotype as a control. The cells found to express DCTa melanocyte stem cell markers.
Discussion

Owing to the ethical concerns surrounding the use of embryonic stem cells (ESCs) in research and therapy, adult mesenchymal stem cells have gathered much attention in research and therapy. The plasticity and immunomodulatory properties of MSCs, in particular, have been a boon to their use as candidates for cellular therapies in regenerative medicine \[1\]. The applicability of these cells in regenerative medicine spans a broad spectrum of diseases ranging from cancer to neurodegenerative diseases to skin diseases\[27,28\]. In the recent past, the use of MSCs in cosmetology with specific connotation to hair loss and skin diseases like psoriasis is gaining interest. Several methods to isolate and characterize MSCs have emerged in the purview of their translational applications. This study presented a simplified and an efficient technique to isolate melanocyte stem cells from hair follicles. Flow Cytometry results confirmed that the isolated cell population was melanocyte stem cells. This would prove to be effective in the production of functional melanocytes in vitro, which can be used in the treatment of skin diseases like vitiligo and psoriasis \[29\].

Conclusion

In conclusion, the study revealed an efficient method of isolation of melanocyte stem cells. The cells were confirmed for their characteristics by flow cytometry analysis of positive and negative markers. Functional analyses of the isolated cells would further confirm its usage in cellular therapies for treatment of skin pigmentation disorders.

Ethical Clearance: The research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding.

References


A Comparison of Cone Beam Computed Tomography, Panoramic and Digital Periapical Radiography in the Detection of Chemical and Mechanical Created Peri-Implant Bone Defects

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College of Dentistry/ University of Babylon, Iraq

Abstract

In dental practice, radiography is the most common technique used to diagnose peri-implantitis. Intraoral radiographs provide a bi-dimensional image of the peri-implant bone. In cases in which tridimensional visualization of the bone is required, cone beam computed tomography (CBCT) may be alternatives. The choice of the ideal technique depends in part on its availability, ease of use, and patient acceptance. The aim is to compare the diagnostic potentials and practical advantages of PA and CBCT imaging systems in detecting chemically simulated defects around dental implants with different sizes.

Forty implants (n = 40) were placed in bovine ribs and divided into two groups: (1) control group (n = 8) and (2) test group (n = 32). The test group was divided into two subgroups: T1 (4 hours of acid exposure), T2 (12 hours of acid exposure). CBCT and digital periapical images were acquired. One oral and maxillofacial surgeon (OMS) and two oral and maxillofacial radiologists (OMRs) evaluated the presence of defects, and their findings were compared with direct visual evaluation. Confidence in diagnosing the presence or absence of a peri-implant radiolucency was recorded on a five-point scale. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (LR+), negative likelihood ratio (LR-) and accuracy of the apparatus were calculated.

CBCT were better at diagnosing a peri-implant bone defect when compared with PA. As the peri-implant space increase there was no significant difference in diagnostic accuracy between the two imaging methods. Accuracy of CBCT (71,88%) was better than PA (43,75%), sensitivity of CBCT (73,33%) was better than PA (65%). Specificity and positive predictive value of CBCT better than PA. The negative predictive value of PA (12,5%) was higher than CBCT (11,11%).

Within the limitations of this study, CBCT are a reliable and valid method of detecting circumferential peri-implant bone defects and performed significantly better than PA.

Keywords: cone beam computed tomography; dental radiography; dental implants; bone defect.

Introduction

Peri-implantitis is known as a biofilm-related infection of the hard and soft tissues surrounding dental implants. Clinical symptoms show typical signs of inflammation such as bleeding on probing, pus release and/or suppuration, swelling, redness of the soft tissue and pain on palpation.

Undetected and untreated peri-implantitis may lead to implant failure in terms of implant loss, and early detection of peri-implantitis is paramount. Radiographic examination has thereby become a standard for the
evaluation of the peri-implant bony conditions. Peri-implant bone defects may be found in implants with marginal alveolar bone loss, peri-implantitis and other inflammatory disorders [3].

Accurate diagnosis of these defects is becoming increasingly important in oral implant dentistry. However, in some cases, it is very difficult to detect these defects in clinical examinations alone. Two-dimensional radiography techniques are widely used to assist in this assessment, but these methods have limitations such as distortion and superimposition of adjacent structures that limit the visualization of bone defects, particularly as regards bucco-lingual walls [4,5]. So that Cone-beam computed tomography (CBCT) (a three-dimensional technique that has several applications) can be used as alternative [6-10].

The aim of this study was comparison of cone beam computed Tomography and digital periapical radiography in the detection of chemically created peri-implant bone defects versus gold standard (direct visual analysis of the rib blocks).

Materials and Method

Bovine rib preparation

Fresh bovine ribs obtained from a local slaughterhouse were prepared by removing the soft tissues and cutting them into 10 blocks measuring approximately 45 x 16 x 12 mm (length/height/thickness) to simulate the size of the posterior region of the human mandible [11]. The ten rib blocks were divided into five groups of two blocks each. Individual acrylic supports were made to stabilize two blocks simultaneously and simulate the spatial positioning and perimeter of the mandible body (figure 1).

Bone defect and implant placement

Forty implants (n = 40) were divided into two groups: (1) control group (n = 8) and (2) test group (n = 32). The test group was divided into two subgroups: T1 (4 hours of acid exposure), T2 (12 hours of acid exposure). All the implant sites were to receive a 3.6*10mm implant. The defect sites were randomly assigned to the groups.

Erosions were made in the test group around the cervical region of the implant site, to simulate peri-implant bone defects. They were created using a 70% perchloric acid solution [12-14].

After defrosting the rib, standard cotton was removed from a swab and saturated with 0.1 mL of 70% perchloric acid. The saturated cotton was always placed in the cervical region of the implant site. The site was then covered with wax and the ribs were turned upside down so that the acid would act on the cervical region. At the end of the acid exposure period, the cotton was removed and the implant site was washed with distilled water to remove all traces of acid (figure 2).

Radiographic image evaluation

The criterion for the analysis was as follows: CBCT and digital PA radiograph versus gold standard (direct visual analysis of the rib blocks).
visual analysis of the rib blocks.

The detailed settings for these devices were as follows:

CBCT scan (GENDEX DP- 800); 90 kV and 6,3 mA, acquisition time 4.5 s, FOV 8*15 cm (X:0,0mm ,Y:0,6mm ,Z:5,0mm) (figure 4)

Figure 4: CBCT scan ( GENDEX DP- 800).

Intra oral device (care stream CS2200) (70 KV, 7 MA, 0,227 Exposure time)

The presence/absence of bone defects was diagnosed by a 3-point scale

1- Definitely not present
2- Probably not present
3- Uncertain present or not
4- Probably present
5- Definitely present.

Comparisons among test groups performed using One – way ANOVA and Post Hoc analysis (LSD), Independent samples T test and Paired samples T test. P ≤ 0.05 was considered as significant.

Results

Diagnostic evaluation

The table (1) show the diagnostic evaluation of PA apparatus when compared with direct visual examination as a gold standard, in which there is (13) true positive results, (11) false positive results, (7) true negative results and (1) false negative results.

<table>
<thead>
<tr>
<th>Golden standard</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test</strong></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>24</td>
</tr>
<tr>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>32</td>
</tr>
</tbody>
</table>

The table (2) show the diagnostic evaluation of CBCT apparatus when compared with direct visual examination as a gold standard, in which there is (22) true positive results, (1) false positive results, (8) true negative results and (1) false negative results.
Table 2: Diagnostic CBCT apparatus * Gold standard Cross tabulation

<table>
<thead>
<tr>
<th></th>
<th>Golden standard</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CBCT</strong></td>
<td><strong>Test</strong></td>
<td><strong>+</strong></td>
<td><strong>-</strong></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>22</strong></td>
<td><strong>8</strong></td>
<td><strong>1</strong></td>
<td><strong>30</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>9</strong></td>
<td><strong>2</strong></td>
<td><strong>32</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Accuracy of apparatuses.

The table (3) present the sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, negative likelihood ratio and accuracy, in which the sensitivity of CBCT (73.33%) better than PA (65%) while specificity of CBCT (50%) better than PA (8.33%). The PPV of CBCT (95.65%) higher than PA (54,17%) while NPV of PA (12.5 %) higher than CBCT( 11,11%). The positive likelihood ratio of CBCT (1,47) higher than PA (0,71) while the negative likelihood ratio of PA (4,20) higher than CBCT (0,53). The accuracy of CBCT (71,88%) higher and significantly better than PA (43,75%)

Table 3: Comparison between PA and CBCT

<table>
<thead>
<tr>
<th>Apparatus</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>LR+</th>
<th>LR-</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>65.00%</td>
<td>8.33 %</td>
<td>54.17%</td>
<td>12.50 %</td>
<td>0.71</td>
<td>4.20</td>
<td>43.75%</td>
</tr>
<tr>
<td>CBCT</td>
<td>73.33%</td>
<td>50.00 %</td>
<td>95.65%</td>
<td>11.11 %</td>
<td>1.47</td>
<td>0.53</td>
<td>71.88%</td>
</tr>
</tbody>
</table>

Discussion

This in vitro study was carried out to investigate the possible differences among modern imaging modalities in detecting peri-implant radiolucencies with various sizes and to compare the practical aspects of their daily usage based on the common perceptions of actual clinicians with different backgrounds. The present findings mainly indicate that such variations in the visibility of bone defects exist among radio-graphic systems. As expected, larger defects generally presented a greater possibility of radiographic detection, whereas the diagnostic accuracies of the imaging modalities were found to differ for bone defects of the same size. Clinically acceptable detection rates as well as good inter-observer and intra-observer agreement value were found in the present study for CBCT image. The results clearly demonstrated that CBCT has good sensitivity and specificity in the detection of simulated peri-implant bone defects and that CBCT performs significantly better than PA in this regard. This concordance with many of the findings from studies within periodontology and endodontology where CBCT has been found to be significantly better at identifying bone loss than periapical radiographs [16,17]. To define which modality offered the highest diagnostic potential, the same experimental model was used in different radiographic devices. This approach in turn required multiple repeated radiation exposures at very short intervals. The simulated peri-implant circumferential marginal crestal defect made chemically with 70% perichloric acid.

In an experimental study, Sirin and colleagues [19] evaluated the diagnostic potential and practical advantages of CBCT in detecting bone defects around dental implants. They created crestal bone defects around implants and compared images obtained with conventional periapical radiography, panoramic radiography, CBCT and multislice CT. They found that periapical radiographs allowed a faster and more confident assessment of peri-implant radiolucencies than either of the other modalities. CBCT was found to have a comparable ability to detect peri-implant radiolucencies but was associated with slower decision making and
lower image quality than traditional imaging modalities. However, unlike the results found in the present study, those authors found that CBCT showed a similar accuracy as PR and DDR in the detection of defects with the smallest diameter but was inferior in image quality. Unlike the aforementioned study, we did not assess decision-making speed or image quality of different radiographical modalities since these factors are subjective and observer dependent. This concordance with [10, 20] compared the diagnostic accuracy of conventional periapical radiographs and CBCT in detecting peri-implant bone defects. They found that digital periapical images were better than CBCT images in diagnosing peri-implant bone defects when the bone defect was smaller than 0.35 mm. However, when the bone defect was larger than 0.675 mm, no significant difference was seen in diagnostic accuracy between the imaging methods. These findings are due to the experimental design of this study, which may have biased the results. The defect size was large, and the presentation of CBCT images was static (signal) rather than dynamic, as in the present study.

FOV size was reported as one factor that may influence the accuracy of peri-implant defect detection in CBCT images. They found that FOV size does not affect defect detection 22. In the present study, we did not test the influence of FOV size, since the FOV was fixed (8*15 cm) and could include the maxilla and the mandible, according to the manufacturer. According to [23] both 6x6 and 8x8 FOVs were appropriate for visualizing peri-implant bone defects. Although the smaller FOV (4x4 cm) in association with the smaller voxel size (0.08 mm) provided a higher rate of detection, caution must be used due to the increased radiation dose.

As this was an in vitro study, the results presented here may be slightly different in clinical practice, especially when one considers the differences between the bovine ribs used and a patient’s head, where there are more structures in the path of the X-ray beam 24. Another limitation may be that the tomographic aspect of the created defects may differ from those of real defects, as the former were standardized and the defects created with chemical methods, which may not represent the clinical aspect of bone lesions 25.

Conclusion

Within the limitations of this study, dependent on these results, the CBCT are a reliable and valid method of detecting circumferential peri-implant bone defects and performed significantly better than pan and pa.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

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References


The Efficacy of Essential Oils (Lavender Oil and Flaxseed Oil) in Treatment of Recurrent Aphthous Ulceration

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Abstract

RAS is a common oral disease, with an estimated prevalence of 25%. Topical treatment with corticosteroids, antibiotics, and analgesics are highly recommended for patients with RAS. However, longer treatment may cause fungal infection and drug resistance. Alternative safe treatments are highly favorable.

About 200g of lavender was steeped in cold pressed flaxseed oil so there should be enough to cover the flowers put in air tight container and let the flowers steep in the oil about 48 hours in warm place and shake every few hours, then filter out the flowers by coffee filter. The straining process was repeated until clean oil without plant material was obtained. Total of 32 patients aged from (18-35) years were diagnosed having aphthous ulcer for not more than one day of ulcer beginning.

Pain relief was achieved with 81% of patients with 100% reduction in the intensity of pain and significant reduction in the size of ulcer. Significant complete healing achieved in the fifth day of treatment with 50% of the cases.

The present study has confirmed that flaxseed oil and lavender oil combination have bioactive properties that make it safe and effective in promoting ulcer healing process.

Keywords: Flaxseed oil, lavender oil, aphthous ulcer.

Introduction

Recurrent aphthous stomatitis (RAS), or recurrent aphthous ulcer (RAU), is one of the most common oral diseases, with an estimated prevalence of 25% [1]. Many factors may be involved in its progression, such as immunological abnormalities, genetic predisposition, psychological stress, hormonal state and microbial infection [2]. Since the etiology and pathogenesis of RAS remains unclear, currently there is no definitive curative therapy. The commonly accepted management strategy is to lessen the pain and duration of lesions [3]. Topical corticosteroids, antibiotics, and analgesics are highly recommended for patients with RAS [4]. However, longer treatment and frequent exposure to these medications may cause fungal infection and drug resistance [5]. Natural herbal medicines as an alternative therapy for RAS have been widely used in many countries for decades [6]. Clinical studies on the use of such remedies have reported favorable benefits to patients by reducing the discomfort and duration of ulcers [7]. The researchers’ interest in the biological and physiological activities of essential oils has been increased. Some essential oils were suggested to act as anti-inflammatory [8], antiviral [9], anti-tumor [10], anti-hyperglycemic [11], and anti-carcinogenic [12] agents. One of the most potent and famous essential oils that was used for treatment of fungal infections is lavender oil [13]. Lavender genus is an important member of the Lamiaceae family. Lavandula species are widely distributed in the Mediterranean region and cultivated in France, Italy and Spain. The Lavandula augustifolia Mill. specie is well known among people as a powerful aromatic and medicinal herb [14]. The plant is used in traditional and folk medicines of different parts of the world for the treatment of several rheumatoid, gastrointestinal, and nervous disorders [15]. Lavender essential oil is expected to have a beneficial effect on wound healing because a few evidences for its effect were already reported [16]. Flaxseed oil (Linum usitatissimum) has proved several therapeutic effects.
Its components have showed antioxidant, antiviral, antibacterial, antifungal, anti-inflammatory and anti-atherosclerosis properties \(^{16}\). It has been postulated that fatty acids found in these oils may exert beneficial health effects by the modulation of signaling pathways regulating cell differentiation and proliferation \(^{15}\). Daily flaxseed consumption is safe \(^{17}\) and it protects gastric and urinary tracts membranes, heals scars, protects inflamed skin, improves its elasticity and nourishes and regulates also hair follicles cycle \(^{18}\). These properties of flaxseed have motivated us to investigate the effects of topical application of the its oil on oral ulcer healing.

The objectives of this study are to determine the efficiency of essential oils (flaxseed oil and lavender oil) in the treatment of oral aphthous ulceration.

**Materials and Method**

Flaxseed oil was purchased from a local herbalist. The type of flaxseed oil that was used in this study is cold pressed oil. Cold pressed oil is oil produced through a combination of grinding and low heat. Exposure to heat affects the fatty acids in the oil and make it loose the therapeutic benefits. Lavender oil was home made by using the flaxseed oil and dried flower cuttings. We used about 200g of cuttings (dry flowers). About100g of lavender was steeped in flaxseed oil so there should be enough to cover the flowers put in air tight container and let the flowers steep in the oil about 48 hours in warm place and shake every few hours, then filter out the flowers by coffee filter. Then we added the other 100g of lavender flowers and pour the oil back and again let it steep another two days. The straining process was repeated until clean oil without plant material was obtained.

In this study, 32 patients aged from (18-35) years were diagnosed having aphthous ulcer for not more than one day of ulcer beginning.

**Results**

Pain relief was highly seen in study group with percentage up to 81% while control group was only 37.5%.

For reduction in the intensity of pain was 100% in our study group while the control group was 37% (P value was significant).

<table>
<thead>
<tr>
<th>Groups</th>
<th>Clinical observation</th>
<th>1st day</th>
<th>3rd day</th>
<th>5th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study group (RAU patients no. 16)</td>
<td>Pain relief</td>
<td>2</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Reduction of intensity of pain</td>
<td>3</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Control group (RAU patients no. 16)</td>
<td>Pain relief</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Reduction of intensity of pain</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

**Table 2: Size and healing of ulcer**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Clinical observations</th>
<th>1st day</th>
<th>3rd day</th>
<th>5th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAU study group Patient no. 16</td>
<td>Reduction of size of ulcer</td>
<td>0</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Complete healing of ulcer</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Control group (RAU) patients no.16</td>
<td>Reduction of size of ulcer</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Complete healing of ulcer</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
For reduction in the size of ulcer: our study group showed 75% while the control group was only 18.7% after five days.

Complete healing seen in half of the patients 50% in our study group while the control group was zero (0%) after five days.

Comparisons between the two groups showed more variation as the period reach day (5) while in day (1) and (3) the variation was seen slightly.

Discussion

Phytochemicals are naturally occurring and biologically active chemical compounds found in plants. Many previous studies have investigated the composition of flaxseed, and the differences between their results are related to the used extraction methods. Monica and Joseph (2016) have reported the presence of, terpenoids, saponin, quinones, phenols, steroids, betacyanin and coumarins in aqueous flaxseed extracts. Bekal et al. (2015) described flaxseed powder aqueous extracts to be +ve for glycerides, saponins, alkaloids and flavonoids, and -ve for sterols, terpinoids and tannins. It was noted that after cold extraction; the majority of bioactive compounds found in the seeds are present in the oil. Thus, linseed oil is rich with fats, flavonoids, glycosides, phenols and tannins which could make it useful in some

Flaxseed oil is a source of diverse biologically active compounds that have been reported to act on one or several phases of wound healing process. Its richness in flavonoids may promote the viability of collagen fibrils that leads to an increase in the strength of collagen fibers and a reduction of cell damage by improving DNA synthesis [22]. In association to some polysaccharides found in flaxseed, flavonoids also stimulate fibroblast cells proliferation [23]. As well as their differentiation into specialized myofibroblasts in the granulation tissue which helps wound contraction and enclosure [24]. In addition, flaxseed contains high amounts of minerals such as magnesium (Mg) and calcium (Ca) as well as manganese (Mn) and copper (Cu) but in lower quantities [25]. It has been demonstrated that early increase of Cu, Mg and Mn leads to more stable and solid collagen [26]. Ca is known to regulate inflammatory cells infiltration, fibroblasts multiplication and keratinocytes proliferation, differentiation and migration [27]. Lavender essential oil is expected to have a beneficial effect on wound healing because a few evidences for its effect were already reported [28, 29]. A previous randomized control trial conducted on 120 women demonstrated that treatment with lavender oil significantly reduced pain after episiotomy and redness of incision sites as compared to control [30]. More recently, another randomized clinical trial for episiotomy demonstrated the similar results; significant reduction of REEDA (redness, edema, ecchymosis, discharge and approximation) score and visual analogue scale score for pain, as compared to control [31]. Also, it was reported that topical application of lavender oil on aphthous ulceration showed a significant ulcer size reduction as compared to control in both an animal experiment and a clinical study [32]. Our study results was demonstrated significant reduction in ulcer size, pain intensity and the duration of complete healing by topical application of these two essential oils.

Conclusion

The present study has confirmed that flaxseed oil and lavender oil combination have bioactive properties that make it effective in promoting ulcer healing process. Moreover, they do not produce any adverse effects which make these oils a promising treatment of wounds or ulcers. Therefore, there is need for more studies and experiments to characterize the structure and activity of each component alone or in combination with others to provide successful formulation of products for oral ulcer treatment.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

References


Quantification of *Streptococcus mutans* Associated with Dental Caries in Iraqi Children by Real-Time PCR

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Al-Qadisiyah University, Iraq

**Abstract**

*Streptococcus mutans* is a common pathogen causing dental caries in human. A specific and rapid method to detect streptococcal species in human saliva simultaneously was quantitative real-time polymerase chain reaction (qPCR). This study aims to quantitative detection of *Streptococcus mutans* in dental plaque by real-time PCR and to compare their presence with the propagation of dental caries in Iraqi children. Dental plaque samples were collected from 120 children aged 3-10 years old, the children were divided into three groups (caries-free, ECC, severe ECC) according to the mouth and teeth’s health status: caries-free group (CF) (n=40), early childhood caries group (ECC) (n=40) and severe-early childhood caries group (S-ECC) (n=40). The quantitative real time PCR of *S. mutans* was performed by two specific primers gtfB and UNI targeted to glucosyltransferase gene and 16S rRNA gene that revealed 91.6% (110/120) of total samples were positive of *S. mutans*. The amplification assay by primers gtfB and UNI were more sensitive for detection of *S. mutans* quantities of oral samples in three dental caries statuses. There was a significant difference between the levels of *S. mutans* in the dental plaque samples of the three groups (P < 0.05), the quantitative levels of *S. mutans* were significantly higher in S-ECC children compared to CF and ECC groups. The quantities of *S. mutans* were closely associated with the prevalence of dental caries in the children with S-ECC.

**Keywords:** Dental caries; *Streptococcus mutans*; Real-time PCR

**Introduction**

*Streptococcus mutans* is closely associated with the development of early childhood caries it’s one of cariogenic microorganisms integrated with dental caries that based on the observed strong association of levels of *Streptococcus mutans* in plaque and dental caries and the development of dental caries has been proposed related to quantification of *S. mutans* in plaque of patients (1). Today, dental caries remains the most common chronic infectious disease of childhood in worldwide (2), according to the American Academy of Pediatric Dentistry and several studies have been done to identify the relationship between the dental caries with the timing of the initial colonization of the oral cavity as well as with the burden of infection with *S. mutans* (3). In order to three dental caries are identified caries free status (CF), early childhood caries (ECC) is defined as the presence of one or more decayed, missing teeth or filled tooth surfaces in any primary tooth in a child 6 years old or younger and children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC) (4). The various methods have been used to identify *S. mutans*, including colony morphology on mitis-salivarius agar culture; however, culture methods suffer from limitations that impact the accuracy and consistency of assessing the infection with *S. mutans* (5). In addition to the direct enzyme tests and enzyme-linked immunosorbent assays, which are time-consuming, laborious, and relatively unspecific results, therefore be inappropriate for rapid diagnostic examinations. Quantitative real-time PCR (qPCR) have been potential and reliable means of rapid detection and quantification of mutans streptococci in biological
samples (6). The qPCR system using species-specific primers can provide precise and sensitive method for detection and quantification of bacterial species (7).

This work was attempted to describe a method for the absolute quantification of \textit{S. mutans} in a sample has advantages that not only the presence or absence but amount of \textit{S. mutans} can be related to clinical conditions in children dental plaque samples for the classification on the basis of dental caries status caries free (CF), early childhood caries (ECC) and severe-early childhood caries (S-ECC) of Iraqi children.

**Materials and Method**

**Patients with dental caries in children**

The study included saliva samples were collected from 120 children of both genders that age ranging 3-10 years old who were attending to dental unit of Al-Hussein Teaching Hospital and the College of Dentistry, Al-Muthanna University. The children samples were divided into three groups according to the mouth and teeth’s health status: caries-free group (CF) (n=40), early childhood caries group (ECC) (n=40) and severe-early childhood caries group (S-ECC) (n=40). The standard strains of \textit{S. mutans} (ATCC 25175) and three different bacterial species \textit{Streptococcus gordonii DL–1}, \textit{Streptococcus sobrinus} and \textit{Escherichia coli} DH5α which are most frequently in the oral cavity were selected from the stock culture collection in Public Health Laboratory, Baghdad.

**Extraction of Bacterial DNA**

The one milliliter of saliva samples were spun by centrifugation 11,000 rpm at 4°C for 10 min., that resulting pellets were subjected to directly DNA isolation according to a protocol previously described (8), while the bacterial strains were isolated from an overnight culture grown at 37°C in brain heart infusion broth, then the bacterial cells boiled in 200 ml of lysis solution (10 mM Tris-HCl buffer, 1 mM EDTA, 1% Triton X- 100, pH 8.0) for 10 min. After centrifugation, the supernatant was used for genomic DNA extraction. Extraction of genomic DNA from both bacterial cells and saliva pellets were performed by Genomic DNA Isolation Kit (Norgen Biotek, Canada). DNA concentration and quality were analyzed of all samples using a NanoDrop 8000 spectrophotometer (Thermo Fisher Scientific, USA).

**Real-time PCR Assay**

In order to quantification of \textit{S. mutans}, the tenfold serial dilution of bacterial suspension was performed and independently enumerated with the DCC-560 digital colony counter (Human Lab., Korea), bacterial counts were estimated using colony forming units (CFU) per ml. The standard curve of real-time PCR was generated by genomic bacterial DNA extraction from the different serial dilutions and the concentration was measured and adjusted to 1μL of DNA to define CFU. The average of CT values between serial dilutions points of standard curve. To determine the total quantity of bacteria, standard curve from \textit{S. mutans} ATCC 25175 bacterial strains was produced with real-time PCR, by using DNA control from standard bacterial culture, which ranged from 0.001 to 100 ng/ml. The quantity of DNA was calculated from the standard curve for \textit{S. mutans} ATCC 25175. After the final cycle of qPCR, analysis of the cycle threshold (Ct) and melting temperature (Tm) values were carried out on all the amplified samples. Samples were negative for bacterial species when their values (Cт) and (Tm) were lower than those detected in the DNA standard curve. The amplification of gtfB and 16S rRNA genes was selected according to the previous studies using gtfB primer (9) and UNI primer (10), respectively. To test the specificity of the primers, 3 bacterial species found most frequently in the oral cavity (\textit{Streptococcus gordonii DL–1, Streptococcus sobrinus} and \textit{Escherichia coli} DH5α) were used as templates for qPCR with gtfB, and UNI primers. SYBR-Green qPCR was performed by Mx3000P real-time PCR (Stratagene Technologies, USA). Each PCR mixture consisted of 10μl of SYBR Green 2X Luna Universal qPCR Master Mix with 0.2 μl low Rox dye, 1μl of primer mix 10 μM (forward and reverse), 2μl template DNA, and added nuclease-free water to complete final reaction volume 20μl. The qPCR conditions were initial denaturation for 10 minutes at 95°C, followed by 40 cycles of denaturation for 15 seconds at 95°C, annealing temperature 55.4°C for gtfB primer and 60°C for UNI primer in 15 seconds and extension at 68°C for 7 min. The segment of melting curve was performed using one cycle in 60–95°C for 1 min.
Table 1: PCR primers used in this study.

<table>
<thead>
<tr>
<th>Gene</th>
<th>Primer</th>
<th>Sequence 5'-----3'</th>
<th>Product size (bp)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>16S rRNA</td>
<td>Uni152-F</td>
<td>CGCTAGTAATCGTGGATCAGAATG</td>
<td>69</td>
<td>(9)</td>
</tr>
<tr>
<td></td>
<td>Uni220-R</td>
<td>TGTGACGCGCGGTGTGTA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>gtfB</td>
<td>gtfB-F</td>
<td>CTACACTTTCCGGGGTGCTTG</td>
<td>261</td>
<td>(10)</td>
</tr>
<tr>
<td></td>
<td>gtfB-R</td>
<td>GAAGCTTTTCACTGTTGAGCTG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistical Analysis

Wilcoxon’s test was used for statistical evaluations. P value of less than 0.05 is regarded as significant. *One way ANOVA and Post Hoc analysis test were used for multiple comparisons between the dental caries groups.

Results and Discussion

The early presences of *S. mutans* of dental caries consider as prognosis of dental disease and take the management of treatment. The current study showed the relationship between the quantities of *S. mutans* in the dental plaque statuses that detected by real-time PCR amplified of DNA template from saliva samples that was most accurate and reliable method to identify bacterial load in clinical samples, since saliva is easy and noninvasive sampling, it has been used to evaluate the caries activity of individuals (11). A positive correlation between the quantity of pathogenic bacteria in saliva and severe dental caries has been established in several studies (12, 13). It is possible that showing the causative bacteria to a patient is a more effective behavior incentive than only giving information about the number of caries lesions present. This information would be beneficial to target the more efficient preventive treatment in these cases, incentive them to maintain adequate home care. The previous studies showed that the ratios of *S. mutans* in relation to the total number of streptococci in dental plaque ranged from 0.01 to 0.5 (14). The relationship has been clarified the relevance between the frequencies of *S. mutans* and the dental caries status of the Japanese children (15).

The PCR specificity of amplifying the species-specific target sequence of *S. mutans* can be given by specific primers. In our study, the regions of GTFB and 16S rRNA genes were used for designing PCR primers GTFB and UNI primers respectively. The standard curve for bacterial quantification was created by using 10-fold serial dilutions of *S. mutans* (Fig.2). Evaluation of the primer pair to enumerate total bacteria was performed with serial dilutions using 3 different bacterial species described above. Dissociation curves showed a sharp peak at the expected Tm of the products (Fig. 3), indicating that each real-time PCR specifically amplified the target DNA.

The infected samples of *S. mutans* was detected that about 21 (52.5%) as positive samples with gtfB primer and 30 (75%) with UNI primer of the CF group, 32 (80%) as positive samples with gtfB and 34 (85%) with of the ECC group and 26 (65%) as positive samples with gtfB and 26 (65%) with UNI of the S-ECC groups. The positive samples of *S. mutans* were significant association (P < 0.05) to the dental caries status groups (CF, ECC and S-ECC groups) by PCR experiment using primer GTFB as shown in table 2 and primer UNI in table 3.

Table 2: Prevalence of dental caries with *S. mutans* detected by real-time PCR related to dental caries status related to primer gtfB.

<table>
<thead>
<tr>
<th>Dental caries status</th>
<th>No.</th>
<th>Primer gtfB</th>
<th><em>S. mutans</em> negative</th>
<th><em>S. mutans</em> positive</th>
<th>Z</th>
<th>P. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caries free(CF)</td>
<td>40</td>
<td>0.02±0.003</td>
<td>0.03±0.003</td>
<td>-3.162*</td>
<td>0.002*</td>
<td></td>
</tr>
<tr>
<td>Early childhood caries (ECC)</td>
<td>40</td>
<td>0.02±0.007</td>
<td>0.04±0.003</td>
<td>-2.812*</td>
<td>0.005*</td>
<td></td>
</tr>
<tr>
<td>Severe-early childhood caries (S-ECC)</td>
<td>40</td>
<td>0.02±0.012</td>
<td>0.06±0.007</td>
<td>-2.805*</td>
<td>0.005*</td>
<td></td>
</tr>
</tbody>
</table>
Table (3): Caries prevalence in dentition with and without *S. mutans* detected by real-time PCR related to dental Caries status related to UNI primer.

<table>
<thead>
<tr>
<th>Dental caries status</th>
<th>N</th>
<th>UNI Primer</th>
<th></th>
<th>Z</th>
<th>P. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S. mutans</td>
<td></td>
<td>S. mutans</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-ve)</td>
<td></td>
<td>(+ve)</td>
<td></td>
</tr>
<tr>
<td>Caries free(CF)</td>
<td>40</td>
<td>0.07±0.030</td>
<td>60</td>
<td>0.60±0.072</td>
<td>-2.805-b</td>
</tr>
<tr>
<td>Early childhood caries (ECC)</td>
<td>40</td>
<td>0.15±0.030</td>
<td>53</td>
<td>0.15±0.151</td>
<td>-2.807-b</td>
</tr>
<tr>
<td>Severe-early childhood caries (S-ECC)</td>
<td>40</td>
<td>0.35±0.035</td>
<td>82</td>
<td>0.108</td>
<td>-2.812-b</td>
</tr>
</tbody>
</table>

Values given are the means ± standard deviations. Statistical evaluations used Wilcoxon’s test .

§ P < 0.05, b. Based on negative ranks.

†There are significant difference between – and + results of two primers at *P < 0.05.

Increases of the caries severity makes the Detection of *S. mutans* increased significantly, the multiple comparison between CF, ECC and S-ECC groups regarded to two primers showed that levels of *S. mutans* were significantly higher in S-ECC children compared to CF and ECC children related to UNI and GTFB primers as showed in (table 4) and (table 5) respectively. Similarly, the ratio of S. mutans to total bacterial count was significantly higher in the S-ECC and ECC groups in this study. The ratio of children detected with *S. mutans* has only been 25% and there were 10% of children without detected S. mutans in their saliva (17). In this study, *S. mutans* was detected in 85% children without dental caries, 90-92.5% of children with dental caries, which showed higher detection rates than those of previous studies. However, there was a statistical difference between three groups of children and. S. mutans levels increased with caries severity. The proportions of *S. mutans* to the total bacteria are considered to be less (18). The results showed the close association between the prevalence of dental caries and the ratio of *S. mutans* by real-time PCR. This assay is easy to perform and reduced the detection time. *Mutans streptococci* is one of the most reliable caries predictor stems because caries-conducive conditions on enamel as well as on the root surface are associated with elevated levels of these organisms in saliva and/or in a plaque (19). Getting information about the total amount of bacteria and the composition of *S. mutans* may aid in the assessment of an individual’s risk of dental caries. However, further studies using molecular techniques with large cohorts are necessary to substantiate our findings and to confirm the quantity of *S. mutans* related to the caries statue to assess an individual’s risk of dental caries, especially in the primary dentition, although the assessment of caries risk in populations remains uncertain when based on single measurements only (20).

The main limitation of this study that the collection of plaque samples were from saliva samples only; therefore, the bacterial composition could have been different if samples collected from carious sites. In addition, since the qRT-PCR is very sensitive, the sampling procedure could greatly affect the accuracy of results.
Table 4: Multiple Comparisons between the three groups of dental caries related to gtfB primer.

<table>
<thead>
<tr>
<th>Primer GTFB</th>
<th>Mean Difference</th>
<th>P.Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-ECC</td>
<td>-.010*</td>
<td>.000</td>
</tr>
<tr>
<td>ECC</td>
<td>-.036*</td>
<td>.000</td>
</tr>
<tr>
<td>CF</td>
<td>.010*</td>
<td>.000</td>
</tr>
<tr>
<td>S-ECC</td>
<td>-.026*</td>
<td>.000</td>
</tr>
<tr>
<td>CF</td>
<td>.036*</td>
<td>.000</td>
</tr>
<tr>
<td>ECC</td>
<td>.026*</td>
<td>.000</td>
</tr>
</tbody>
</table>

*One – way ANOVA and Post Hoc analysis to (S. mutans) + show significant difference at the 0.05 level among three Dental caries status

Table 5: Multiple Comparisons between the three groups of dental caries related to UNI primer.

<table>
<thead>
<tr>
<th>UNI Primer</th>
<th>Mean Difference</th>
<th>P.Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECC</td>
<td>.070</td>
<td>.185</td>
</tr>
<tr>
<td>S-ECC</td>
<td>-.221*</td>
<td>.000</td>
</tr>
<tr>
<td>CF</td>
<td>-.070-</td>
<td>.185</td>
</tr>
<tr>
<td>S-ECC</td>
<td>-.291*</td>
<td>.000</td>
</tr>
<tr>
<td>CF</td>
<td>.221*</td>
<td>.000</td>
</tr>
<tr>
<td>ECC</td>
<td>.291*</td>
<td>.000</td>
</tr>
</tbody>
</table>

*One – way ANOVA and Post Hoc analysis to (S. mutans) + show significant difference at the 0.05 level among three Dental caries status.

Figure 1: Amplification plots of chromosomal DNA from lysed cells. Serial dilutions of chromosomal DNA were from S. mutans, The log-transformed relative fluorescence [dRn(log)] was monitored as the increase in reporter dye intensity relative to the passive internal reference dye The threshold fluorescence, or level at which the threshold cycle was determined, is shown, Ct is the cycle number at which the threshold fluorescence was reached.
Conclusion

*S. mutans* could be detected quantitatively and sensitively by real-time PCR with UNI and gtfB primers, and the ratios of *S. mutans* on S-ECC and ECC groups have a higher quantity of *S. mutans* than CF group, thus, this bacteria have a significant impact to prevalence of dental caries in Iraqi children.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

References


The Role of Frizzled-Related Protein3 Frzb3 Gene Polymorphisms` in Iraqi Patients with Knee Osteoarthritis

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²Dept. of Chemistry and Biochemistry, College of Medicine, Al-Nahrain University, Iraq,  
³Rheumatology Unit, Dept. of Medicine, College of Medicine, University of Baghdad, Iraq

Abstract

Osteoarthritis is a degenerative articular disease that has a complex pathogeny because various risk factors interact in the process of cartilage deterioration. From the 50’s it’s known that certain forms of osteoarthritis are related to an alteration of genetic component.

This study aim to investigate possible association between KL grade, clinical features (WOMAC) and susceptibility polymorphisms to OA, such as FRZB3 gene, to better define the grading of this disease for prevention, early diagnosis, and treatment.

Total of 120 Iraqi patients affected by primary OA, aged (45 years and above) and 60 healthy people (control) at the same age range, with no family history of OA were evaluated at Al-Imamein Al-Kadhimein Medical City (Rheum. Dept.). The degree of severity of knee OA was assessed by clinical and radiographic assessment. FRZB rs7775 genotyping is performed using DNA sequencing and the level of serum sfrp3 protein is measured using Human sfrp3 ELISA Kit

Genotyping of FRZBrs7775 polymorphisms revealed that three different genotypes. Also it was revealed highly significant difference in the two alleles (C, G) frequencies between control and Knee OA patients (p>0.001) that the highest allele G frequency was found in Knee OA patients group (odd ratio 13.1) with CI (6.12- 28.03). No significant difference was noted in the serum concentration of sFRP3 between the three groups (severe, mild and control).

In this study, 120 of Iraqi people with severe and mild Knee OA are mostly of GG and CG genotypes in the FRZB3rs7775 gene polymorphisms and this alteration in genotype of FRZB3 gene doesn’t affect the serum level of sFRP3 protein.

Keywords: frizzled-related protein3 FRZB3 gene, secreted frizzled-related protein3 sfrp3. Knee osteoarthritis.

Introduction

Knee osteoarthritis (KOA) occurs as the cartilage in the knee wears away eventually causing bone on bone contact between joint surfaces. Most common complaints include joint swelling, joint stiffness, and pain. KOA can be diagnosis via radiographs indicating boney cysts, narrowing joint space, and sclerosis of the bone. This will eventually lead to pain and loss of function (1). Various risk factors such as genetics, aging, obesity and joint deformation may be related with KOA occurrence and progression (2, 3).

The genetic background of OA likely involves multiple genes that encode proteins with significant functions in the underlying disease process, suggesting that genetic factors are strong determinants of OA development (4).
For that, molecular genetic investigations have gained an increasingly significant role in the knowledge of OA etiology (5-7).

The Frizzled Related Protein gene (FRZB) is a member of a family of the soluble Wingless (Wnt) antagonist. Evidence has demonstrated that products of Wnt and Frizzled play a key role in the development and maintenance of bones and joints (8, 9). The rs7775 and rs288326 FRZB SNPs variants showed an increased frequency in subjects with generalized radiographic OA, as confirmed by other studies in Caucasian individuals (10, 11). The FRZB gene is mapped to human chromosome 2q31-33 and consists of 6 exons and 5 introns (12).

Mutations that only clinically associated variants of FRZB are Arg200Trp (exon 4) and Arg324Gly (exon 6). Both of them are substitutions for a conserved arginine residue. It is found that a haplotype coding for Arg200Trp and Arg324Gly substitutions in FRZB was a strong risk factor for primary hip OA in females (13).

The FRZB gene, encodes for SFRP3, is involved in both the bone formation and the negative regulation of Wnt pathway and maintaining the structure of the cartilage (13) and mutations in this gene are related with the development of osteoarthritis (14).

The SFRP3 protein of 325 amino acids is widely expressed in adult mammalian tissues regulating cell growth and differentiation (15).

**Materials and Method**

This case-control study is of 120 Iraqi patients affected by primary OA with no family history of OA and sixty 60 healthy people (control) aged (45 years and above). Samples were obtained at Al-Imamein Al-Kadhimein Medical City (Rheum. Dept.), Baghdad, Iraq during the period from March to May 2017 after submitting all the subjects (patients and control) to clinical (Western Ontario and McMaster Universities Arthritis Index WOMAC) scale (16) and radiographic (Kellgren and Lawrence KL) grading scale (17) examination and according to these tow examinations, subjects were divided into the following 3 groups:

60 (35 females+ 25 males) subjects with mild OA.
60 (35 females+ 25 males) subjects with severe OA.
60 (35 females+ 25 males) healthy people as control.

All subjects having one of the following conditions were excluded from the study; Any other pathological condition that could explain the symptoms (e.g. other rheumatic disease, previous knee joint replacement, intra-articular fractures, septic arthritis, ligament or meniscus damage), Pregnant patients and Co-morbidity precluding physical evaluation.

Renal functions test, complete blood picture and ESR test were done for all subjects to make sure they don’t have any renal dysfunction that could affect the level of serum sfrp3 protein and to exclude those having rheumatoid arthritis. Physiological factors such as BMI, age and gender were evaluated in this study.

About 2ml of blood were obtained by vein puncture and put into Ethylene diamine tetra acetic acid (EDTA) tubes to store at -70°C to be used later for genetic analysis. DNA extraction was done using Genomic DNA G- spin DNA extraction kit supplied by Intron Biotechnology, cat.no. 17045. For analyzing the variation of FRZB gene, PCR amplification was done for all subjects using specific primers pair supplied by IDT (Integrated DNA Technologies company, Canada) (table 1).

**Table 1: Primer for FRZB gene (18)**

<table>
<thead>
<tr>
<th>Primer</th>
<th>Sequence</th>
<th>Tm (°C)</th>
<th>GC (%)</th>
<th>Product size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward</td>
<td>5’- CCTCTTGGCAGCAATTGGAAC- 3’</td>
<td>56.9</td>
<td>52.4</td>
<td>884 base pair</td>
</tr>
<tr>
<td>Reverse</td>
<td>5’- GCCCCTCTCTCAGAAAAATG- 3’</td>
<td>56.2</td>
<td>52.4</td>
<td></td>
</tr>
</tbody>
</table>
Total of 25µl of PCR product has prepared for each sample and sent for sequencing, to Macrogen, Korea., 2 directions are analyzed (forward and reverse) for significant analyses by the following web sites used in Bioinformatics analysis: National Center for Biotechnology Information (NCBI) database and Ensemble databases. DNA Sequence analysis done using basic local alignment search tool (BLAST) program from NCBI. Analysis of Single nucleotide polymorphism (SNP) also were done using the tools that provided by these sites. 120 PCR product were treated with DNA sequencer 3730XL, Applied Biosystem machine. in national instrumentation center for environmental management NICM/USA company online at (http://nicem.snu.ac.kr/main/en_skin=index.html). The result of the sequence analysis was analyzed by blast in the National Center Biotechnology Information (NCBI) online at (http://www.ncbi.nlm.nih.gov) and BioEdit program to detect gene mutation and polymorphism in DVWA gene.

Blood samples sfrp3 protein were separated and frozen at -20°C before analysis. Sfrp3 protein levels were measured by using Enzyme-Linked Immunosorbent Assay (ELISA), Human sfrp3 ELISA Kit Cat. No. MBS7238827, MyBioSource.com/ USA.

The data are presented as mean values ± S.E. Comparison of data between two groups was performed by applying a Student’s \( t \) test, and ANOVA (analysis of variance) and post hoc Tukey test was used for comparison of means of more than two groups \( p < 0.05 \) values were considered significant, while for genotyping and allele frequency calculation, the online Hardy-Weinberg equilibrium calculator was used. Chi-square test was used to significant compare between percentages in this study. To assess clinical applicability (sensitivity, specify and predictive values) a receiver operator curve was constructed and the area under the curve was calculated.

**RESULTS**

There was no significant difference in the level of serum SFRP3 in the three study groups (\( p=0.244 \)) (table 2).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control N=60 Mean±SE</th>
<th>Mild N=60 Mean±SE</th>
<th>Severe N=60 Mean±SE</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFRP3 (ng/ml)</td>
<td>7.69±0.41</td>
<td>6.71±0.55</td>
<td>7.64±0.42</td>
<td>0.244</td>
</tr>
</tbody>
</table>

The table (3) demonstrated that no significant correlation between the level of sFRP3 and the age of subjects in each study group.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Age (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Severe</td>
</tr>
<tr>
<td>SFRP3</td>
<td>0.199</td>
</tr>
<tr>
<td>r</td>
<td>0.128</td>
</tr>
</tbody>
</table>

The table (4) reveals three genotypes; homozygote wild genotype WT (CC), heterozygote genotype H (CG) and homozygote mutated genotype MUT (GG). The WT (CC) shows the highest percentage of 86.7% in control group compared to mild and severe KOA groups 45.0%, 21.7% respectively (\( p>0.001 \)). A highly significant difference (\( p<0.001 \)) in distribution of MUT (GG) genotype among the three groups. Whereas H (CG) has
the highest percentage of 40.0% in mild Knee OA group compared to severe and control KOA groups 33.3% 13.3% respectively (p<0.001).

Table 4: Genotyping distribution of FRZB3rs7775 gene polymorphism in the three groups

<table>
<thead>
<tr>
<th>Group</th>
<th>FRZB Total</th>
<th>P value</th>
<th>Odd ratio 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CC (WT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CG (H)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GG (MUT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>52 (86.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 (13.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 (0.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>&lt; 0.001*</td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>27 (45.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 (40.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 (15.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>13 (21.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 (33.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>27 (45.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H, heterozygote; MUT, homozygote; WT, wild type.

Table 5: Distribution of FRZB3 genotype according to sex within each group

<table>
<thead>
<tr>
<th>Gender</th>
<th>Control</th>
<th>Mild</th>
<th>Severe</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GG</td>
<td>CG</td>
<td>CC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GG</td>
<td>CG</td>
<td>CC</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0 (0.0%)</td>
<td>4 (11.4%)</td>
<td>31 (88.6%)</td>
<td>0.708</td>
</tr>
<tr>
<td></td>
<td>4 (11.4%)</td>
<td>14 (40.0%)</td>
<td>17 (48.6%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 (45.7%)</td>
<td>11 (31.4%)</td>
<td>8 (22.9%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0 (0.0%)</td>
<td>4 (8.0%)</td>
<td>21 (92.0%)</td>
<td>0.824</td>
</tr>
<tr>
<td></td>
<td>5 (20.0%)</td>
<td>10 (40.0%)</td>
<td>10 (40.0%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 (44.0%)</td>
<td>9 (36.0%)</td>
<td>5 (20.0%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.925</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Fisher exact test and chi square test

High Significant difference (p>0.001) in allele C frequencies between control and mild KOA group 93.3%, 65.0% respectively. Also the allele G showed high frequency 35.0% in mild KOA group compared to control group 6.7%, giving highly significant difference (p>0.001). The odd ratio was 7.538 with confidence interval (3.36-16.94) (table 6).

Table 6: Distribution of alleles of FRZB3 in control and mild knee OA groups

<table>
<thead>
<tr>
<th>Group</th>
<th>C Total</th>
<th>G Total</th>
<th>P value</th>
<th>Odd ratio 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(93.3%)</td>
<td>(6.7%)</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>112</td>
<td>8</td>
<td>&lt;0.001*</td>
<td>7.538</td>
</tr>
<tr>
<td></td>
<td>3.36-16.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild OA</td>
<td>78 (65.0%)</td>
<td>42 (35.0%)</td>
<td>120</td>
<td>7.538</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>50</td>
<td>240</td>
<td>7.538</td>
</tr>
</tbody>
</table>

* Fisher exact test
There is a high significant difference in allele G frequency 61.7% in severe KOA group compared to mild group 35.0% (p>0.001). While the allele C showed high frequency 65.0% in mild group compared to severe group (p>0.001). The odd ratio was 2.988 with CI (1.77-5.05).

The FRZB3 gene was registered and obtained accession number as a reference to Iraq and the Middle East and the world. It is available at NCBI:

https://www.ncbi.nlm.nih.gov/nuccore/MH006580?fbclid=IwAR3NXLyseyTW0MrV7h6jeLE3sQCa5S5aMJfsc9x0WVr8yQ3N-QI9QfDs7s

Discussion

In this present study, no significant difference was noted in the level of serum SFRP3 in the three groups (p=0.244) and that may be attributed to FRZB polymorphisms produce SFRP3 protein at the same level but in inactive form decreasing its ability to antagonize WNT signaling.

Many studies indicated that regulatory effects acting on FRZB expression are moderate and that the major means through which FRZB impacts the OA phenotype is through the arginine substitutions decreasing the ability of sFRP3 to antagonize Wnt signaling (19).

A study on Caucasian women ≥65 years of age showed that the highest SFRP3 serum levels were associated with a modest reduction in the risk of the incidence of hip OA (20).

It is known that FRZB gene that encodes for Sfrp3 protein is one of antagonists that are considered key factors in maintaining cartilage homeostasis by diminishing terminal hypertrophic differentiation in long-bone explant cultures (21).

Other study showed that sFRP3 contributes to cartilage/bone homeostasis and disease (22).

There is a number of novel studies reporting that SFRPs can also activate Wnt signaling in specific circumstances (23). Xavier et al. showed that SFRP1 has a complex role within the regulation of the Wnt signaling (23). It can act as an inhibitor or an enhancer, depending on the cellular context, the concentration, and Fz receptor expression patterns. Its activity can be described as biphasic (24).

Peng et al. in 2014 found that SFRP3 (100 ng/ml) significantly reduces βcatenin protein levels. Interestingly, SFRP3 co-treatment may reduce the effects of Wnt3 which activates the canonical Wnt pathway (25).

Recent study found that the expression of SFRP3 protein was lost with the increased severity of OA and it was negatively correlated with OA grading showed the proposed protective role of SFRP3 in articular cartilage from OA progression (26).

Other study shows significant effects of SFRP3 on OA and confirms the involvement of WNT signaling mechanisms in joint pathology and suggesting that SFRP3 signals influence the expression of some anti-apoptotic proteins, especially fibronectin (27).

Our findings suggest that Iraqi people with severe and mild Knee OA are mostly having GG and GC genotypes of the FRZB3rs7775 gene that indicates the allele G of Arg324Gly polymorphism may be considered as risk factor of increasing individual’s susceptibility for developing knee OA. Also mutation in FRZB3rs7775 gene doesn’t affect the serum level of sFRP3.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

References


A Comparative Study for Movement of Sword Fencing Stabbed According to the Technical Programming in the Game of Fencing Wheelchairs Class B

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Abstract

Expert systems are essential for the development of the educational and training process, which helps in the development of many training requirements, as it depends on mathematical analysis to solve a problem. Therefore, the use of technical programming to study the comparison between the Iraqi and foreign model to reach the important differences in the development of motor performance. The researchers used the technical programming in the comparative descriptive approach to suit the nature of the research procedures, and the researchers found that there are significant differences between the Iraqi and foreign model in the rotation angle variable and the quantitative speed.

Keywords: Sword fencing, technical programming, fencing and wheelchairs.

Introduction

The scientific development has added a lot of modern means. Trainers can benefit from them in order to prepare the areas of expertise for the players to reach the upper levels. Therefore, the postmodern era we are living in now has many characteristics, including the information revolution, the cognitive explosion, the rapid pace and the shift from material investment to intellectual investment. And other transformations, contemporary international experience has shown that evolution is based on training, and that it is the essence of global competition.1

Computer expert systems are an essential necessity for developing the training process in the light of modern innovations. It takes into account the individual differences by presenting and analyzing the performance. It provides all the necessary information about the skill performance, which may help to develop many training requirements. Expert systems “are very advanced systems that use expert human methods and are integrated with the characteristics of the smart machine using logic and mathematical analysis to solve a problem, or perform an important task, as if the program used for that purpose is expert in its work.”1

The game of wheelchair fencing as one of the individual games for handicapped people with motor disabilities that require speed and accuracy in performance is working to take advantage of all the findings of modern science to face the problems encountered by training to prepare players able to adapt to the changes of the era and deal with the problems and achievements, Fencing on wheelchairs The speed of the attack towards the opponent, and suddenly, and precision in directing the fly weapon to the target of the competitor for the purpose of getting touch, so the computer was introduced in the smart software in what is known as expert systems and programming skill performance, New concepts calling for increased reliance on computer techniques in training. The importance of research in the performance of professional skills according to the system of the expert, which may have a positive impact and experience in the performance of the movement of the challenge on the wheelchair fencing, which may

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improve the level of performance and achievement, so there was a need for a study in this area. One of the reasons why we make expert systems is to “preserve knowledge from extinction or extinction,” meaning the unique value knowledge that exists only when a person is a distinguished expert in his specialty.2

The skill performance in the game of dueling on wheelchairs depends on the application of the technical aspects in an integrated manner. Some of our trainers may miss the fact that their dependence on the identification of errors on self-observation or non-technical observation and self-evaluation, which is flawed due to speed of movement and variable variability and difficulty of compatibility. On the progress made in the means of scientific observation and reliance on objective judgment, the researchers found the need for diagnosis of errors and evaluation of the technical performance in the movement to challenge the reliance or use of the program designed to program the performance of the skill, giving the program full visibility what must be achieved performance conditions that may directly affect the achievement of the best level of performance and then achieve a good achievement. The aim of the study is to build a Java programming system for programming the skilled performance of the B-class wheel-drive challenge. And compare the performance of the players in the final of the Rio de Janeiro Games for the handicapped according to the technical programming of the movement of the challenge of the game on the wheelchair B class B. The researchers hypothesized that there were significant differences between the players and the winning player.3

Methodology

The researchers used the descriptive approach in the style of comparative studies to suit the nature and problem of the study.

Society and sample research:

The sample of the research was the number of attempts from the original search community by lot and by (10) attempts for each player, thus the sample of the attempts (20).

Methods, tools and devices used in the research:

- Arab and foreign sources.
- Advisor system (will be detailed later).
- Note.
- Laptop Calculator Number (1) Type (hp)
- Manual calculator of type (CASIO).
- Software and applications used in computer for motor analysis.
- Video camera type (Sony) to shoot the game.

Field research procedures:

The researchers analyzed the performance of the players and after analyzing the imaging, the search variables were extracted, namely the angular velocity, quantitative velocity, kinetic energy and velocity, under study and performance comparison between the players. For the purpose of extracting the investigated variables and their use in building a software system designed by the researchers as a performance model. After analyzing the skill performance and data acquisition, the data were processed statistically “to obtain the results.

Statistical procedure:

The researchers processed the results of the tests by the appropriate statistical means through the statistical program (SPSS), which includes the following approved laws:

- The arithmetic mean.
- Standard deviation.
- (t) For independent samples.

Results

Presentation and analysis of the results of the comparison of the skillful performance of the wheelchair challenge and discussion on wheelchairs:
Table (1). Shows the computation of the computational circles, the standard deviations, the calculated value (T), and the statistical significance between the two research groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Iraqi Model</th>
<th>Foreign model</th>
<th>(t) Calculate</th>
<th>Level of significance</th>
<th>Significance type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>STD.EV</td>
<td>Mean</td>
<td>STD.EV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation Angular</td>
<td>73.96</td>
<td>11.89</td>
<td>90.27</td>
<td>3.12</td>
<td>4.19</td>
</tr>
<tr>
<td>Angular velocity</td>
<td>72.59</td>
<td>32.97</td>
<td>45.88</td>
<td>30.94</td>
<td>1.86</td>
</tr>
<tr>
<td>Velocity</td>
<td>365.45</td>
<td>161.48</td>
<td>216.78</td>
<td>13.84</td>
<td>2.44</td>
</tr>
<tr>
<td>Kinetic energy</td>
<td>3.153</td>
<td>1.61</td>
<td>4.59</td>
<td>2.09</td>
<td>1.72</td>
</tr>
</tbody>
</table>

The results showed that there was a significant difference in the Rotation Angularity and Velocity variance. The researchers attributed the difference to the difference in muscle strength between the players according to their medical classification to include the back muscles, which affected the tilt of the trunk in front, which occurs at the moment of appeal and the greater the player made a longer time in the quick return to the back, as confirmed by (Abdel Hadi Hamid and Abdul Karim Fadel) as “a mistake T-player in the movement of appeal is committed by: Mel trunk forward hindering the rapid return. As well as to make the body of the player as a target close to the rival, which limits the achievement of the extent of the wider movement of the trunk and arm during the process of the challenge of the highest possible speed, which gives a mechanical advantage of the attack process carried out by the player as “muscle increases working in the joints to produce the largest speed Angle it, and move this speed into the armed arm at the moment of appeal.

The researchers also found that there were no differences in computational and standard deviations. In order to identify the differences, the researchers used the T test for independent samples. The results showed no significant difference in Angular velocity, Kinetic energy. The ideal performance of the players in the development of the body during the stages of movement and the continuation of the acceleration process to the moment of appeal, which is the most important and fastest movement by which the player to get a touch, “as well as speed and compatibility, which ends by pressing the weapon fly on the goal of the competitor. In addition, the performance of the two players was consistent with the correct mechanical performance in terms of position of the trunk and the flow of the movement and the follow-up of the armed arm to the last moment, and each contribution made an active contribution in the regulation of the motor between the nervous and musculoskeletal systems. The locomotive towards a particular target.

Conclusions

The study showed that there are significant differences of statistical significance according to the skill programming system between the two groups in Rotation Angular and Velocity variables and in favor of the foreign model.

The study showed no significant differences of statistical significance according to the skill programming system between the two groups in Angular velocity, Kinetic energy variables.
Ethical Clearance- The research sample is reviewing the medical rehabilitation and physiotherapy center at Babylon University in the Faculty of Physical Education and Sports Sciences.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

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5. Cardoso VD, Haiachi M de C, Reppold Filho AR, Gaya ACA. The structural and human resources support for Brazilian Paralympic athletes. 2018;
An Analytical Study of Cervical Spine Pain According to the Mechanical Indicators of the Administrative Work Staff

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Iraq/University of Babylon/The College of Physical Education & Sport Sciences/ Ph.D. in Sports Medicine

Abstract

The feeling of pain is a global problem since long ages have passed and are still going on to this day, if we look at how much they distract from daily painkillers for the purpose of alleviating the pain among those suffering from . There are many therapeutic methods used in the treatment of pain or reduce it according to the theories developed according to the foundations of scientifically to reduce the suffering and solving modern pain problems, science of biomechanics is one of the most important modern methods considered in the study of the causes of pain and finding appropriate solutions to ease the pain or remove it by dealing with the human body structure, so the researcher found that a special study in the large proportion of cervical region pain in disability of the staff in the administrative side and who practice their work for long hours in accordance with the mechanical indicators vital, it has a significant role in increasing hours of daily production.

The descriptive approach was used to suit the nature of the research procedures. The sample of the selected research sample was (10) employees suffering from chronic cervical pain after the homogeneity of the research sample was conducted in the variables of height, weight, age, number of years of work and the number of years of pain. To rely on scientific resources and expertise of researcher to obtain. After the required data were treated statistically through (SPSS) program to obtain the required results, and based on what has been extracted from the results, the researcher reached the most important conclusions, which is that the performance of the daily work of the same style of repeated Joel to the occurrence of an imbalance in the function of the cervical region. Also increased tension in the muscle group without the other in the cervical region works the loss of manpower on the joints of the cervical region balance, causing chronic and constant pain.

Keyword: Cervical spine, pain and mechanical indicators.

Introduction

The sense of pain is a global problem for long periods of time has been and continues to this day, if we look at the amount of daily distraction to relieve the pain of those who suffer. The pain today, no longer opposed to a disease, but became a disease in itself, and the techniques vary today and developed for the treatment of pain, and not only treatment of drugs, but to include exercise and change the lifestyle, as well as personal behavior and breathing correctly... etc. of the means that Play a major role in relieving pain and remission.

In addition to what was mentioned in the income of the science of biomechanics today as an important way to treat or reduce pain by studying the state of balance and instability that occur in any region of the human body especially the cervical region of the study, as studies have shown that imbalance in the stability of the joint or muscle weakness Working on it plays a big role in the incidence of injury or pain.

The vast majority of employees live a monotonous life of boredom and turmoil. Their lifestyles are unhealthy, and they are subjected to psychological and
physical pressures, which turn into a state of pain that may interfere with their work and affect their functioning and management. The large proportion of suffering found by researcher in the name of pain cervical region, which is one of the most common injuries in the office administrative staff who sit for long periods of their administrative work.⁴

In light of the above, the researcher studied the pain that occurs in the cervical region according to mechanical indicators to identify the most important causes and the possibility of searching solutions to avoid injury or pain in the cervical region. Therefore, researcher studied the pain in the cervical region of the employees in the administrative work, which work long hours according to vital mechanical indicators, in order to reach positive solutions and maintain the health of the employee because it has a large role in increasing the hours of production daily.⁵

**Neck pain and cervical anatomy:**

The neck region is a geometric arrangement of bones, nerves, muscles, ligaments and tendons. The spine in the cervical region is thin and sensitive and passes through the spinal cord, which sends the brain through the messages to control all parts of the body. It is also characterized by strength and flexibility, allowing movement in all directions.⁶

The cervical region consists of seven vertebrae starting from the base of the skull and connected to the thoracic spine. The cervical spine is at risk of a number of painful conditions due to pressures and forces that influence it, whether due to trauma or daily activities that are unorganized and highly effortless. The cervical spine is a coordinated network of nerves, bones, joints and muscles directed by the brain and spinal cord. The cervical region is designed to withstand the strength, stability and communication of brain impulses to the rest of the body.⁷

There are a number of problems that contribute to pressure on the cervical region, and pressure on the nerve roots in the cervical region can cause problems in the delivery of the nerve signal correctly, causing pain in the shoulder, head, arm and hand.

The cervical spine gives the skull the possibility of rotation in most cervical vertebral levels, which can be described as follows:⁸

- A pair of opposite joints connects the two vertebrae, which can move forward, backward and over.
- Between the vertebrae there is a cartilage disc, which gives stability, spacing and consistency between the vertebrae.
- Nerve roots extend from the spinal cord and come out through the nerve aperture that is separated by two vertebrae, located on the left and right sides of the spine.

Most of the spine problems in the neck region develop over time, due to accumulated injuries and weak muscles in the neck region. Neck problems are caused by pressure on nerves or spinal cord roots that increases pain in the cervical region.

**Research objective:**

Conducting an analytical study of cervical pain in the region, according to mechanical indicators in the administrative staff.

**Hypothesis:**

There is a statistically significant relationship between pain in the cervical region and biomarker indicators among administrative staff.

**Research Areas:**

**Human Field:** A sample of the staff of the University of Babylon for the academic year (2017-2018).

**Time domain:** for the period from 1/10/2017 to 10/9/2018.

**Spatial Field:** Laboratory of Sports Medicine in the Faculty of Physical Education and Sports Sciences / Babylon University.
Research Methodology:

The researcher used the descriptive method, in the method of correlative relationships to suit the nature of research procedures.

The research sample:

The random sample was randomly selected from people who practice their administrative work continuously without rest periods, which rely more on the written side than the 30 computer users who suffer from cervical pain due to work and long hours without, as show in table (1) for the homogeneity of the research sample in the variables of length and age, number of years of work and number of years suffering from pain as follows:

Table (1). Shows homogeneity of the research sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Measuring units</th>
<th>Mean</th>
<th>SD</th>
<th>Mode</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Year</td>
<td>42.4</td>
<td>44.5</td>
<td>48</td>
<td>0.8</td>
</tr>
<tr>
<td>Length</td>
<td>Meter</td>
<td>1.83</td>
<td>1.86</td>
<td>1.88</td>
<td>0.52</td>
</tr>
<tr>
<td>Weight</td>
<td>Kg</td>
<td>90.2</td>
<td>91.5</td>
<td>80</td>
<td>0.096</td>
</tr>
<tr>
<td>Years of work</td>
<td>Year</td>
<td>22</td>
<td>22.5</td>
<td>20</td>
<td>0.542</td>
</tr>
<tr>
<td>Years of pain</td>
<td>Year</td>
<td>6.8</td>
<td>6.5</td>
<td>5</td>
<td>0.689</td>
</tr>
</tbody>
</table>

The above table shows that the sample of the research is homogeneous among them in the variables mentioned above, since the value of the skewness coefficient ranged between (±1).

Equipment and tools used in the search:

- Sony camcorder (16) megapixels.
- A capacity of (8) KB.
- One camcorder holder.
- Convert Cable (HD).
- Kenova Analysis Program.
- Adhesive phosphorylation indicators.

Determination of measurements and tests used in research:

Based on the personal experience, the research variables were measured based on the nature of the work of the members of the research sample. The practical side of the sample was simulated to obtain the ideal results that each of them attends throughout the daily working period.

Method of analysis and data collection:

The data of the variables under study were obtained by photographing the members of the research sample during the performance of the tasks assigned to them during their work today. The camcorder was installed in a vertical manner with the seating of the employee concerned. This is in line with the nature of the procedures for which the research was conducted. Body mass index (BMI) was also adopted to extract head mass values for each member of the research sample to obtain the variables under study described in the equation below.

\[ \text{Head weight} = \text{body weight} \times \frac{7}{100} \text{ kg} \]

According to the above, the search variables were extracted according to Figure (1), the most important of which are:

- The torque of the musculoskeletal muscle.
- The strength of the musculoskeletal muscle.
- The endurance of the cervical ligament.

8/11/2017, on two of the sufferers suffering from chronic pain in the cervical region. The purpose of the exploratory experiment is to identify the obstacles that may face the researcher during the tests and measurements concerned with the research.

**Statistical methods:**

SPSS was used to process the data collected according to the measurements and tests used in the research.

**Results and Discussions**

View, analyze and discuss the results of weight of the head and the momentum generated in the joints of the cervical region and the strength of the lever muscle of the head:

**Table (2). Shows the mean and the standard deviation of the variables in the research**

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head weight</td>
<td>30</td>
<td>64.15</td>
<td>9.44</td>
</tr>
<tr>
<td>Torque (C2_C3)</td>
<td></td>
<td>456.58</td>
<td>108.20</td>
</tr>
<tr>
<td>Torque (C3_C4)</td>
<td></td>
<td>407.25</td>
<td>96.512</td>
</tr>
<tr>
<td>Torque (C4_C5)</td>
<td></td>
<td>371.35</td>
<td>88.004</td>
</tr>
<tr>
<td>Torque (C5_C6)</td>
<td></td>
<td>369.17</td>
<td>87.49</td>
</tr>
<tr>
<td>Torque (C6_C7)</td>
<td></td>
<td>456.08</td>
<td>108.08</td>
</tr>
<tr>
<td>Muscle strength erector of cervical</td>
<td></td>
<td>81.57</td>
<td>18.62</td>
</tr>
</tbody>
</table>

* (C) is the abbreviation of Cervical, which means the neck, or the number next to it, indicating the vertebra number.

Table (2) shows the arithmetic mean and the standard deviation for each of the variables under study in the regression calculation in addition to the number of members of the research sample.

**Table (3). Shows the correlation coefficient(r) between the weight of the head and the variables of torque and strength of joints in the cervical region**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Torque (C2_C3)</th>
<th>Torque (C3_C4)</th>
<th>Torque (C4_C5)</th>
<th>Torque (C5_C6)</th>
<th>Torque (C6_C7)</th>
<th>Muscle strength erector of cervical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head weight</td>
<td>0.916</td>
<td>0.916</td>
<td>0.916</td>
<td>0.916</td>
<td>0.916</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Table (3) shows the correlation matrix, which shows the correlation coefficients between the variables included in the regression. We note that the correlation coefficient values between head weight, cervical joint and cervical stenosis strength are strong, and therefore the stronger the correlation, the more accurate the prediction.
Table (4). Shows the value of the linear correlation (R) and the square (R square) between the dependent variable and the independent variables

<table>
<thead>
<tr>
<th>Sample</th>
<th>R</th>
<th>R square</th>
<th>Adjusted R square</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.919</td>
<td>0.844</td>
<td>0.832</td>
</tr>
</tbody>
</table>

The above table (4) shows the linear correlation value (R) between the dependent variable and the independent variables (the force of the head muscle and the joint determination of (C3-C4). This value is called the multiple correlation, noting that the above correlation is strong, (R square) is the correlation coefficient square (0.844), and the (adjusted R square) value is the (0.832).

Table (5). Shows the value of F to accept the regression of the research variables under study

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean of squares</th>
<th>(F) value</th>
<th>Value of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>2</td>
<td>1090.48</td>
<td>72.85</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>27</td>
<td>14.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table (5) shows that the value of the F test is 72.85, which is a large value greater than (5) indicating that there is a relationship between the dependent variable and the independent variables in question. The sources indicate that the value of F is greater than or equal to 5) we reject the zero hypothesis and accept the alternative hypothesis, this is evidence of a significant relationship between the dependent variable and the independent variables in general. We accept the model in Table (4) to predict the values of the dependent variable.

The results shown in Table (2, 3, 4 and 5) show that there is a very strong correlation between the dependent variable and the independent variables in question, as confirmed by the use of the (F test). On the basis of it was predicted that the most vulnerable part of the injury is the joint between the third cervical vertebra and the fourth cervical paragraph, which is affected by the strength and weakness of the lever muscle of the head.

The cervical region is one of these areas characterized by a complex motor function. It is also surrounded by muscles that serve the sensory system and supports the direction of the head in the space for the chest. The researcher therefore find that the balance of power in these muscles will keep the alignment of the vertebrae above each other Which maintains the balance of the cervical region and prevents pain. Moreover, the movement system in the cervical region is a vital complement to other functions such as breathing, expression and swallowing.

The cervical region is highly dependent on the activity of the cervical supporting muscles. Therefore, the patient’s complaint of what is known as “head weight” is very logical when one considers that the cervical spine flexion is just a muscle that carries at least a load of (20-25%) The researcher found that the vast majority of people who suffer from the term “head weight” or “cervical vertebrae” are caused by weakness of the supporting muscles in the area. In particular, the cervical region with its complex structure is responsible for the movement of the head with the emptiness for the chest, Therefore, the weight of the body in general and the weight of the head in particular is injected In the balance and management of the pain that may be exposed to the cervical region also have an effective role in healing the person from pain.
From the results obtained, the researcher found the strength of the correlation between the weight of the head and the strength of the head muscle, as well as the strength of the correlation between the weight of the head and the momentum generated between the joints of the cervical vertebrae under study. The researcher found a significant conclusion based on the prediction equation, which indicated that the most vulnerable areas are the cervical joint between the third paragraph and the fourth paragraph (C3_C4), which is a contact center between the head and the thoracic crotch, that the highest strength of power is generated in this The point is therefore the balance of strength in the muscles supporting the cervical region will work to maintain the balance of the area without pain.

Ethical Clearance- The research sample is reviewing the medical rehabilitation and physiotherapy center at Babylon University in the Faculty of Physical Education and Sports Sciences.

Conflict of Interest: The authors declare that they have no conflict of interest.

Funding: Self-funding

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An Analysis of the Correlation between Psychosocial Hazard and Work Accidents at Velodrome-Kelapa Gading Light Rail Transit Project by Pt Xyz in 2018

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Abstract

Background: This research examined the field workers in Kelapa Gading LRT project that were susceptible to the psychosocial risk of work stress. Currently, psychosocial hazards raise a concern as this type of workplace hazard along with its significant impact are often unrecognized by workers or management. The number of work accidents also increased due to various factors ranging from physical, chemical, biological, radiological and psychosocial hazards factors. The purpose of this research is to analyze the correlation between psychosocial hazard towards work accident of workers at the Kelapa Gading LRT project by PT XYZ in 2018.

Methods: This research employs a quantitative cross-sectional descriptive method by using the COPSOQ II modified questionnaire and research questionnaire from Goldenhar to measure the independent variable; and research questionnaire to measure the moderating variable. There are three variables: independent variable (eight psychosocial factors), moderating variable (psychosocial risk) and the dependent variable (work accident). This research analyzes the independent variable with moderating variable and then analyzes moderating variable’s relationship with work accident as the dependent variable using Fisher Exact test.

Result: The results show that there is a significant relationship between home-work interface, career development, and job certainty with psychosocial risk; and psychosocial risk has a significant relationship towards work accident. To minimize the adverse impacts of the psychosocial factors, the company should apply a reward system that can be given in material or appreciation of hard work to increase worker motivation and to create active communication between management and workers.

Keywords: Psychosocial Hazard, Psychosocial Risk, Work Accident

Introduction

A rising trend to the number of work accident cases in Indonesia occurred between 2011 – 2014; with the highest number happened in 2013 of 35,917 cases1. At the end of 2015, there were 105,182 recorded work accident cases in which 2,375 of the recorded cases ends with mortality2.

There is a disparate discrepancy among the number of accidents between the industries in Indonesia. The largest work accident contribution comes from the construction sector of 32 – 33% of the total number of work accidents. This greatly outweighs other industries as compared with the transportation sector which contributes to 9%, forestry with 4%, and mining with 2%3.

There are more researches that is focused on investigating and building relations between psychological factors or work stress with injury or work accident in occupations such as agriculture4, offshore oil and gas5, and construction6,7. There needed to be
an acknowledgement that workers often experience inconducive work condition and environments, such as working in untimely shifts, excessive workload, monotonous work, job rotation, unclear role, and conflict with co-workers. These are a few aspects of the psychosocial factors that can cause physical, mental, and emotional health problems, such as musculoskeletal disorder, stress, and psychosomatic diseases that cause the escalating illness due to the occupational relationship. Some research results show that stress, fatigue, and work motivation are included as susceptible factors in causing work accidents. Work stress is defined as a psychological condition which is part of a larger interaction process between humans and their work environment. One of the effects of work stress on the organization is escalating unsafe work conditions and accident levels.

Researchers of occupational health and safety have admitted the importance of checking the relationship between work stressor and injury results for workers in various tasks. Work and organization stressor types, including high work demand, insufficient social support, harassment and discrimination, work environment, and work team composition has proven to escalate the risk of construction workers’ physical and psychological harm and potentially causing injury.

Method

This research uses semi-quantitative method with cross-sectional research design using instruments in the form of questionnaire to find relationships between independent variables which is demands at work, work organization and job contents, interpersonal relations and leadership, offensive behavior, home-work interface, job control, job certainty, and career development with dependent variable (work accident) on workers. Moreover, this research also uses secondary data from the company’s operational data and other supporting literature of an independent or dependent variable taken at the same time, which is in 2018. This research uses univariate and bivariate analysis to analyze the data. Statistic test that is used in this research is the Fisher Exact test with a significance level (α=5%) and confidence level (CI=95%). The result of Fisher Exact test could only conclude whether there is two variables relationship observed from its p-value. The magnitude of relationships between independent variables and dependent variable could be discovered by looking at the OR (Odds Ratio) value.

Results

<table>
<thead>
<tr>
<th>No</th>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Minimal</th>
<th>Maximal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age</td>
<td>30.75</td>
<td>28</td>
<td>9.830</td>
<td>16-58</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Work Period</td>
<td>64.25</td>
<td>42</td>
<td>70.225</td>
<td>6-396</td>
<td></td>
</tr>
</tbody>
</table>

From the table above, the average respondent age is 31 years old where the youngest respondent is 16 years old and the oldest respondent is 58 years old. For the work period, the average respondent works in construction for 64 months or 5 years and 3 months. The shortest respondent work period is 6 months and the longest respondent work period is 396 months or 31 years.

According to Table 2, it is known that from eight psychosocial factors, two variables show higher Good percentage category than the others which are offensive behavior variable and interpersonal relations and leadership.

The intervening variable in this research is psychosocial risks. Psychosocial risks are measured on self and co-workers. According to Table 3, the respondents that have high psychosocial risks on self is 140 people (93.3%) while high psychosocial risks on co-workers are 138 people (92%).
### Table 2. Score Aspect

<table>
<thead>
<tr>
<th>NO</th>
<th>ASPECT</th>
<th>AMOUNT</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demands at work</td>
<td>Poor</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>2</td>
<td>Work organization and job contents</td>
<td>Poor</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>3</td>
<td>Interpersonal relations and leadership</td>
<td>Poor</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td>76</td>
</tr>
<tr>
<td>4</td>
<td>Offensive Behavior</td>
<td>Poor</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td>110</td>
</tr>
<tr>
<td>5</td>
<td>Home-work interface</td>
<td>Poor</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Job control</td>
<td>Poor</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Job certainty</td>
<td>Poor</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>8</td>
<td>Career development</td>
<td>Poor</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Psychosocial risks on self</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Psychosocial risks on co-workers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>11</td>
<td>Has experienced work accident</td>
<td></td>
<td>137</td>
</tr>
<tr>
<td>12</td>
<td>Has never experienced work accident</td>
<td></td>
<td>13</td>
</tr>
</tbody>
</table>

The number of respondents that have experienced work accident is 137 people (91.3%) higher than the number of respondents that have never experienced work accident, which is 13 people (8.7%).

The result of the bivariate analysis is presented based on three calculations. The first one is connecting between each factor with psychosocial risks on self and psychosocial risks on co-workers, the second one is connecting the total of the factors with psychosocial risks on self and psychosocial risks on co-workers, and the last one is connecting psychosocial risks on self and psychosocial risks on co-workers with Fisher Exact test.
<table>
<thead>
<tr>
<th>Psychosocial Factors</th>
<th>Psychosocial Risk on Self</th>
<th>P</th>
<th>OR</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Demands at work</td>
<td>Poor</td>
<td>118</td>
<td>92.9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>22</td>
<td>95.7</td>
<td>1</td>
</tr>
<tr>
<td>Work organization and job contents</td>
<td>Poor</td>
<td>92</td>
<td>94.8</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>48</td>
<td>90.6</td>
<td>5</td>
</tr>
<tr>
<td>Interpersonal relations and leadership</td>
<td>Poor</td>
<td>70</td>
<td>94.6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>70</td>
<td>92.1</td>
<td>6</td>
</tr>
<tr>
<td>Offensive behavior</td>
<td>Poor</td>
<td>39</td>
<td>97.5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>101</td>
<td>91.8</td>
<td>9</td>
</tr>
<tr>
<td>Home-work interface</td>
<td>Poor</td>
<td>123</td>
<td>98.4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>17</td>
<td>68</td>
<td>8</td>
</tr>
<tr>
<td>Job control</td>
<td>Poor</td>
<td>123</td>
<td>94.6</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>17</td>
<td>85</td>
<td>3</td>
</tr>
<tr>
<td>Job certainty</td>
<td>Poor</td>
<td>115</td>
<td>94.3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>25</td>
<td>89.3</td>
<td>3</td>
</tr>
<tr>
<td>Career development</td>
<td>Poor</td>
<td>137</td>
<td>95.1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>3</td>
<td>50</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 4. Correlation between the Eight Psychosocial Factors and Psychosocial Risks on Co-workers

<table>
<thead>
<tr>
<th>Psychosocial Factors</th>
<th>Psychosocial Risks on Co-workers</th>
<th>P</th>
<th>OR</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Demands at work</td>
<td>Poor</td>
<td>116</td>
<td>92.9</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>22</td>
<td>95.7</td>
<td>1</td>
</tr>
<tr>
<td>Work organization and job contents</td>
<td>Poor</td>
<td>92</td>
<td>94.8</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>46</td>
<td>86.8</td>
<td>7</td>
</tr>
<tr>
<td>Interpersonal relations and leadership</td>
<td>Poor</td>
<td>69</td>
<td>93.2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>69</td>
<td>90.8</td>
<td>7</td>
</tr>
<tr>
<td>Offensive behavior</td>
<td>Poor</td>
<td>39</td>
<td>97.5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>99</td>
<td>90</td>
<td>11</td>
</tr>
<tr>
<td>Home-work interface</td>
<td>Poor</td>
<td>122</td>
<td>97.6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>16</td>
<td>64</td>
<td>9</td>
</tr>
<tr>
<td>Job control</td>
<td>Poor</td>
<td>122</td>
<td>93.8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>16</td>
<td>80</td>
<td>4</td>
</tr>
<tr>
<td>Job certainty</td>
<td>Poor</td>
<td>115</td>
<td>94.3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>23</td>
<td>82.1</td>
<td>5</td>
</tr>
<tr>
<td>Career development</td>
<td>Poor</td>
<td>136</td>
<td>94.4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>2</td>
<td>33.3</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 5. Correlation between the Total Eight Psychosocial Factors and Psychosocial Risks on Self

<table>
<thead>
<tr>
<th>Total Eight Psychosocial Factors</th>
<th>Psychosocial Risks on Self</th>
<th>P</th>
<th>OR</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Poor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Poor Category</td>
<td>132</td>
<td>96.4</td>
<td>5</td>
<td>3.6</td>
</tr>
<tr>
<td>Good Category</td>
<td>8</td>
<td>61.5</td>
<td>5</td>
<td>38.5</td>
</tr>
</tbody>
</table>
Table 6. Correlation between the Total Eight Psychosocial Factors and Psychosocial Risks on Co-workers

<table>
<thead>
<tr>
<th>Total Eight Psychosocial Factors</th>
<th>Psychosocial Risks on Co-workers</th>
<th>P</th>
<th>OR</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Poor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Poor Category</td>
<td>131</td>
<td>95.6</td>
<td>6</td>
<td>4.4</td>
</tr>
<tr>
<td>Good Category</td>
<td>7</td>
<td>53.8</td>
<td>6</td>
<td>46.2</td>
</tr>
</tbody>
</table>

Table 7. Correlation between Psychosocial Risks and Work Accident

<table>
<thead>
<tr>
<th>Psychosocial Risks</th>
<th>Work Accident</th>
<th>P</th>
<th>OR</th>
<th>CI 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experienced</td>
<td>Never Experienced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>On Self</td>
<td>High</td>
<td>132</td>
<td>94.3</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>5</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>On Co-workers</td>
<td>High</td>
<td>131</td>
<td>94.9</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>6</td>
<td>50</td>
<td>6</td>
</tr>
</tbody>
</table>

Based on Table 3 up to Table 7, it is discovered that there are significant correlations between home-work interface factor and career development factor with psychosocial risks on self and co-workers also job certainty factor with psychosocial risks on co-workers. The total of eight psychosocial factors are also connected with psychosocial risks on self and on co-workers. Also, there are significant correlations between psychosocial risks on self and co-workers with work accident.

**Discussion**

From the results of the Fisher Exact test, home-work interface factor shows significant correlations to psychosocial risks on self and on co-workers in the form of work stress. OR shows that an individual has a lot or severe conditions or problems at home which escalates the risk of stress by 28.941 times compared with respondents having minor conditions or problems at home. However, the result of this research is parallel with the results of past researches of McShane and Quircck that there is a relation between the home-work interface with stress\(^1\).

This research shows that there are significant correlations between career development with psychosocial risks on self and on co-workers in the form of work stress. OR shows an individual experiencing poor career development has 19.571 times more risk on work stress compared with individuals that do not experience poor career development. This research is not in line with the result of Amalia, Wahyuni, and Ekawati’s research which states that there are no correlations between career development with work stress\(^2\).

The Fisher Exact test result shows that there are significant correlations between job certainty with psychosocial risks on co-workers in the form of work stress. OR shows the respondents experiencing high job uncertainty has 3.571 times more risk of having
psychosocial risks in the form of work stress compared with individuals that do not experience job uncertainty. This result is parallel with Rachman’s research that states there is a relationship between job uncertainty with work stress\(^{13}\). Job uncertainty becomes one of the stress sources that can cause work performance reduction and causing workers to look for jobs in other places\(^{13}\).

OR shows an individual experiencing high psychosocial risks have 16.5 higher risk of work accident compared with individuals with low psychosocial risks. Work stress that is experienced by workers is one of the factors that increase dangerous behaviors that can cause work accidents\(^{14}\).

### Conclusion

Based on the result of the research and its discussions above, the conclusion of this research is as follows:

For work accidents, the number of respondents that have experienced work accident is 137 people more than the number of respondents that have never experienced work accident which is 13 people. For psychosocial risks, the number of respondents having psychosocial risks is 140 people while the assessment number of psychosocial risks on co-workers is 138 people.

For bivariate analysis results, there are significant relations between job certainty factor with psychosocial risks on co-workers. The total of eight psychosocial factors are also connected with psychosocial risks on self and on co-workers. There is a significant relationship between psychosocial risks on self and on co-workers with work accident.

### Recommendation

The company should arrange a more comfortable work environment by implementing a reward system in the form of a bonus or an expression of appreciation to elevate the workers’ motivation.

The company should give compensation to workers that are dealing with urgent family problems and should clarify workers’ status, work period, and their wages.

Workers could communicate properly with the company if there are a few things that are not in accordance with the existing provisions such as when urgent family problems arise.

A quantitative research with interview and observation method to obtain a comprehensive representation of psychosocial risks in the workplace.

Further analysis should be carried out through the multivariate level to find which factor that could be the dominant factor

**Ethical Clearance:** Ethical Clearance is taken from ethics committee in Faculty of Public Health.

Ethical Clearance number : 238/UN2.F10/PPM.00.02/2018.

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**Conflict of Interest:** The authors declare that there is no conflict of interest

### References


The Readiness of Resources The Implementation of Maternal Health Services Indicators for the Minimum Services Standards in Depok West Java Indonesia

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²Department of Health Policy Administration, Faculty of Public Health, Universitas Indonesia, Depok, Indonesia

Abstract

The Maternal health services indicators on the Minimum Services Standard (MSS) states that pregnant women should deliver in standard health service facilities. One of the efforts made for the acceleration of maternal and infant mortality rate is the optimization of handling of emergency neonatal obstetrics/complications of basic service level through Basic Emergency Obstetric Neonatal Care (BEONC). BEONC is one of the health service facilities that provides maternal health services according to MSS. Therefore the reinforcement of BEONC of both service management and support resources must be continuously optimized. This study aims to determine the resources needed to the implementation of MSS maternal health services indicators. Qualitative research was carried out at seven BEONC in Depok City from December 2017 to January 2018. The informants were 38 policy makers at the Health Service level, the head of BEONC, coordinator of BEONC and health officers. To obtain valid results, researchers conducted data triangulation with indept interview and focus group discussion techniques and document review related to the implementation at BEONC. The results showed that human resources had not been prepared with sufficient quantity or quality, standard operational procedures, adequate facilities and operational budget. The conclusion is that the resources were not optimal. Not all the health officers were involved in BEONC, quality control team and the stakeholders not support the implementation.

Keywords: Maternal Mortality Rate/Infant Mortality Rate, Minimum Service Standard, Basic Emergency Obstetric Neonatal Care

Introduction

Childbirth assistance in health care facilities is one of the priority programs that a government should undertake as it is one of the key strategies for reducing maternal and infant mortality. This is proved by the maternal health services indicator in the minimum service standard (MSS) for health sector. This provision is stated in Government Regulation number 2 of 2018 in the Minimum Service Standards. In the regulation, every pregnant woman should deliver her baby in a health care facility that conforms to the standard.

One of the efforts made by the Ministry of Health to continue to reduce the in the Maternal Mortality Rate (MMR) and the Child Mortality Rate is to optimize the handling of emergency neonatal obstetrics complications through the primary healthcare at Basic Emergency Obstetric Neonatal Care (BEONC). The BEONC is a facility that is provided for neonatal obstetric emergency cases which includes pregnant women and maternal and postpartum women with obstetric complications that threaten the mother and/or fetus.

In order for the BEONC, as one of the emergency nodes of the maternal neonatal health service system, to contribute to the reduction of the MMR and Infant Mortality Rate (IMR), it needs to be implemented well in order to optimize its function. This is because the BEONC is an effective intervention for reducing morbidity and mortality rates in mothers and infants in poor areas. In addition, maternal emergency services can reduce maternal mortality due to complications.
related to pregnancy that cannot be predicted. In addition, the BEONC with skilled health workers and accurate referrals to advanced referral health facilities can significantly reduce maternal mortality and morbidity. Therefore, the BEONC from both a service management perspective and supporting resources perspective must be continuously optimized.

In 2017, there were 35 PHCs in Depok city, eight of them were BEONCs, 28 of them were non-nursing, eleven of them were available for 24 hours, and four of them were sub-districts. The number of childbirth delivered by health workers was 41,794 (94.9%) of 44,056 pregnant women. This was obtained by comparing the number of child deliveries by health workers with the number of pregnant women in the area of Depok City. In this case, the number of pregnant women used is real data that available in the field. The target of MSS in the health sector is for all pregnant women should to deliver their babies in health care facilities.

Based on the data above, in order to achieve the target of MSS, the researchers are encouraged to conduct research on the readiness of resources in the implementation of the childbirth health services indicator from MMS at the BEONC in Depok City in 2017.

Method

This research has a qualitative design and was performed at seven BEONC in Depok City from December 2017 to January 2018 after receiving recommendations from the ethics review team. There were 38 informants, who consisted of stakeholders from Public Health Office level, the head of BEONCs, the midwife coordinators of the BEONC and the midwives of BEONC. The selection of informants was based on the principle of suitability and adequacy with the research topic. To obtain valid results, the researchers conducted data and source triangulation with in-depth interviews, focus group discussions and literature review techniques that related to the availability of resources for childbirth care. Guidelines for in-depth interviews and focus discussion were developed from the conceptual framework of systems approach and Edward III’s theory.

Results

The standard for child delivery in the BEONC in term of human resources is that there is a core team consisting of doctors, nurses and midwives who are trained in the BEONC are certified and are competent in neonatal obstetric emergency management in relation to pre-referral stabilization efforts.

The process of officer recruitment introduced in the BEONC in 2012 was conducted by the Public Health Office through the Primary Healthcare Service Section and Referral Healthcare Service Section. The Public Health Office conducted the selection by providing written and interview tests to the candidates. The payment of salaries is within the budget of the Public Health Office. Since 2014, the recruitment process has been submitted directly to the BEONC including salary payment for each BEONC officer. However, the MoU is still regulated and issued by the Secretariat Department and General Department of Public Health Office of Depok City. PHCs haves the flexibility to recruit health workers as needed. However, the quantity and quality of human resources are still inadequate for the implementation of the BEONC. The availability of health workers needed for the implementation of the BEONC is still lacking because almost all types the required human resources are still below the required ratio. In terms of the quality of the human resources there is still a lack of those who have been trained in the BEONC and who have received other training related to the services of the BEONC. Not all the BEONCs have a core team and a support team that have been trained in BEONC.

The BEONC implementation team has been trained in normal child delivery care, obstetric neonatal emergency patient handling and resuscitation. However, not all the BEONC officers have received these trainings, which will affect the competence of the implementation officers. In terms of regulations, Depok City has met the requirements of the BEONC from the perspective of health resources based on the delegation from the Head of PHC regarding the core team, the implementer team, the health promotion team and the non-health workers. However, in terms of competence and involvement in the service, team members have not been optimal because there are still core team members who have not been trained and have not been directly involved in BEONC services. The table below outlines the BEONC human resources:
Table 1. Human Resources at the BEONC Public Health Center in 2017

<table>
<thead>
<tr>
<th>No</th>
<th>Public Health Center</th>
<th>Doctor</th>
<th>Midwife</th>
<th>Nurse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Civil Servants</td>
<td>Non Civil Servants</td>
<td>Civil Servants</td>
</tr>
<tr>
<td>1</td>
<td>Pancoran Mas</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Beji</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Sukmajaya</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Cimanggis</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Tapos</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Bojongsari</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Kedaung</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: BEONC Program Monitoring and Evaluation Report (processed data)

Implementation of policy will not succeed without the support of human resources of sufficient quality and quantity. The quality of human resources is related to their skills, dedication, professionalism, and competence in their field. Quantity is associated with the sufficient number of resources to cover the entire target group. Human resources are very influential in terms of the success of implementation, because without skilled human resources, the policy implementation will run slowly. The results of this study are in line with a study conducted by Bhandari, et al in 2014 that the BEONC with skilled health workers and accurate referral to advanced referral health facilities, can significantly reduce maternal mortality and morbidity. The involvement of health personnel with the BEONC services is one of the indicators of the readiness for the role of PHC. The health workers must be motivated and must be supported continuously with adequate resources to improve skills.

The provision of facilities, infrastructure and equipment in the BEONC in Depok City is managed by West Java Province with the budget coming from the Governor Assistance for four of the BEONCs which includes the Pancoran Mas PHC, Beji PHC, Sukmajaya PHC, and Cimanggis PHC. While the Kedaung PHC gets help in the form of health equipment, the construction of buildings and other facilities is drawn from the local budget of Depok City.

There are six BEONC PHCs that have no problems in providing medicines, consumable materials and the necessary infrastructure. However, this condition does not occur in the Kedaung PHC because it is within the area of the PHC technical implementation unit of Sawangan. In terms of providing medicines, consumable materials and the necessary infrastructure, the Kedaung PHC needs to coordinate with the PHC technical implementation unit in Sawangan. This condition resulted in the slow distribution of drugs and consumable materials.

To assess whether the existing facilities and infrastructure are in compliance with the standard guidelines for the implementation of the BEONCs, the researchers compared the equipment requirements of an inpatient PHC based on the regulation of the Minister of Health Number 75 of 2014 on Public Health Centers. Based on the regulation, the facilities and infrastructure are divided into five parts, the obstetric and gynecological sets, (IUD) insertion and extraction set, infant resuscitation set, consumable materials, equipment and furniture and recording and reporting. The majority of the facilities and infrastructure at the seven PHC were complete, with only in resuscitation section still in complete, as all BEONCs do not have a portable baby suction pump, a infant T piece resuscitator with PEEP and infant T piece system. The infant warmer the Kedaung BEONC PHC obtained from the
Governor of West Java when the BEONC in Kedaung was inaugurated.

The other six BEONCs do not have an infant warmer because it is expensive. However, all the Heads of PHCs stated that it has been included on the list for facilities and infrastructure planning. Nevertheless, the incomplete resuscitation equipment does not interfere with service to the public.

A side from this, the researchers found that all BEONCs had post-birth room facilities and infrastructure that complied with the standard, of the post-birth space infrastructure facilities based on the Regulation of the Minister of Health Number 75 of 2014 on Public Health Center.

The facilities and infrastructure are factors that influence the implementation of the policy. The provision of proper facilities, such as buildings, land and equipment will support the successful implementation of a program or policy. In the research result, it is found that the facilities and infrastructure for the implementation of BEONC activities was good and according to the standard set. Odogwu, et al said that if human resources, equipment and supply deficiency problems can be solved, 24-hour service delivery can dramatically reduce maternal and infant mortality, as in the case for rural women in Northern Nigeria. The low availability and adequacy of the BEONC equipment and drugs may result in inoptimal service or treatment. One of the requirements for a PHC to run the BEONC program oymially is complete facilities and infrastructure, which will allow it to handle cases of childbirth well. According to Setyawan, physical resources refers to a facility that support work allows health workers to optimally perform their role as PHC health service providers.

All funds received by the PHC to fund the BEONC should be well-managed and reported in accordance with applicable regulations. In the study, was found that the operational fund for the implementation of the BEONC run well. Routine operational costs (electricity, water, communications, etc.) were provided by the local government despite assistance being received from other sources of funding. The BEONC had a budget for 24 Hour Basic Health Services and in 2017 it had an allocation for self-employment salaries, expenditure of medicines and consumable materials as well as the purchase and maintenance of the facilities and infrastructure of the BEONC.

In policy implementation, budgets relate to capital or investment adequacy in a program or policy to ensure the implementation of the policy, because without adequate budgetary support, the policy will not effectively achieve its goals and objectives. The limited budget will have an impact on the quality of public services provided to the community, as the planned activities cannot be implemented and the morale of the implementers decreases.

The results of the research are in line with the results of previous research conducted by Handayani, et al which found that funding is very important and necessary as a condition of the sustainability of a program, so it must be allocated appropriately. Likewise, the sustainabilityis affected by the process of provision and usage. The unavailability of funds is one of the factors that contribute to inoptimal operational activities in the BEONC program. According to Wijaya, if the BEONC does not have operational funds and human resources and facilities and infrastructure that meet the standards, then the services provided cannot be optimal. The special funding allocation for the BEONC program is the most important factor. With these funds, the BEONC program can be implemented because it can procure the equipment and emergency medicine needed for the handling childbirth cases.

**Conclusion**

Childbirth health service in the BEONC are not ready yet, as there is a lack of human resources that are sufficient in term of both quantity and quality, there is no uniformity in the number of officers involved among the BEONCs and not all officers are trained. Doctors and nurses in the core team and the support team of the BEONCs have not been actively involved in the implementation. The facilities and infrastructure available and can support the implementation of services. Likewise the budgets available and adequate to ensure routine operational, maintenance and investment activities. However, a calculation is still needed overall BEONC budget for the allocation of MSS activities.

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Ethical Approval

The research received recommendations from the Ethics Assessment Team of the Faculty of Public Health Universitas Indonesia based on Letter Number 569/UN2.F10/PPM.00.02/2017 dated November 14, 2017.

Competing Interest

The Authors declare that they have no competing interest

References

Analysis of Occupational Safety and Health Risk Perception of Elementary School Employees in Depok City, Indonesia

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Abstract

Risk perception is a subjective assessment of the likelihood of an accident and how aware a person is of its consequences. Perception is also an important factor that acts as a precursor to a behavior or a basis for risk prevention. School employees are in direct contact with children, who often have accidents. Therefore, risk perception studies involving school employees are required to develop any necessary accident prevention programs. Ten health and safety risks were chosen, which were being pinched, hit or pricked; falling down the stairs; being hit by a motorized vehicle; fire; natural disasters; noise; food contamination; hazardous chemicals; eye strain; and stress due to workload. Nine psychometric paradigms, namely: voluntariness of risk, the immediacy of effect, known to those exposed to of risk, known to science, controllability, newness, chronic-catastrophic, common-dread, and severity of consequences, were used to evaluate the perception. The population of this study was all teachers and administrative staff at 14 primary schools at Depok City. The total number of respondents was 199 people. This study shows that, of the ten risks studied, a risk that can be accepted voluntarily is eye strain; risks that cannot be accepted voluntarily are fire and contaminated food; a risk that has a delayed effect is stress due to workload; a long-standing risk which has an immediate effect is being pinched, hit or pricked; a risk that is known to science and is often experienced but can be controlled is eye strain; while a risk which has many effects, may be fatal, and is feared and uncontrollable is a natural disaster. It was shown that natural disaster has been perceived as unacceptable risk among ten risks under study. The perception of natural disasters was that they are catastrophic, dreaded, certainly fatal, and sometimes uncontrollable.

Keywords: Risk Peceptions, Occupational Health and Safety Risks, Psychometric Paradigms, School Safety Elementary School.

Introduction

OHS is an important element that must be considered in every type of work. We need to understand the potential hazards and risk patterns in both industrial and non-industrial environments because we are surrounded by potential hazards at all times. Although we can recognize that some aspects are less or more dangerous in different situations, we cannot deal with every risk.¹ Risk is uncertainty that has adverse consequences.¹² Risks are also interpreted as something that will happen, the possibility of results that will occur and how caring for someone if it really happens.¹⁵ The concept of risk is not always the same but it is very helpful for someone to understand and understand the danger and uncertainty because it varies in individuals and in context.¹⁴ Individual differences and perceptions influence a person in responding to potential hazards.²⁰

Safety perception is a manifestation of our beliefs based on the physical safety of the workplace (in this case, the school) and existing protocols for responding to unforeseen disturbances or events.³ Findings from research on school safety perceptions show that, although there are several school safety issues, 99% of respondents surveyed reported that they felt safe after receiving safety training.³ This means that safety training affects teachers’ knowledge. However, in Indonesia, school safety training is rarely conducted in elementary schools.

School safety is very important for everyone in the community because schools nurture our children – our
future. The study demonstrated that employees and students in 9 of the 11 schools under study voiced their concerns about safety. For them, physical safety is a key feature of their perception of school safety. The school climate and staff actions also affect positive safety perception. Basic Health Research by the Indonesian Ministry of Health in 2013 also reported that schools were one of the four main places where the most injuries happen (5.4%). Injuries in schools mostly occur in the age group 5–14 years.

Furthermore, in addition to being educators, teachers and administrative staff are workers whose rights must be maintained, as stated in the 1945 Constitution. In addition, Law No. 14 of 2005 concerning Teachers and Lecturers also affirms the protection of teachers in carrying out their OHS protection. OHS protection includes protection against the risk of job safety disturbances, workplace accidents, fire, natural disasters, work environment health, and other risks.

Depok City is one of the cities in the province of West Java. This province is one of 16 provinces that have injury prevalence above the national average, which is 8.5%. In addition, only 68.6% of elementary education facilities in Depok City have been found to meet the new health requirements. Based on these conditions, this study aims to analyze the OHS risk perception of elementary school employees in Depok City in 2018.

**Method**

This research was conducted to gain an overview of the perceptions of elementary school employees from 14 schools of the ten types of safety and health risks. The total number of teachers and administrative staff in elementary schools which constituted the study sample was 199 people.

The main emphasis of this approach lies in a method that assumes that a person’s risk perception is multidimensional and can be measured using an existing scale. Primary data were collected directly from the teachers and school administrative staff. Respondents were asked about their perception of ten risks at school using the psychometric paradigm. Psychometric studies identified factors that influence the perception of different hazards. The psychometric paradigm has become an interesting basis for examining risk perception because this mode is very simple. Participants assess, for example, newness (are the risks novel or familiar), severity of consequences (how likely is it that the consequences will be fatal), and knowledge about risk (to what extent are the risks known to science). Nine scales were developed from Fischhoff et al.’s study:

- **Voluntariness of risk** (1 = voluntary; 4 = involuntary)
- **Immediacy of effect** (1 = delayed; 4 = immediate)
- **Known to exposed of risk** (1 = unknown to experience; 4 = known to experience)
- **Known to science** (1 = unknown to science; 4 = known to science)
- **Controllability** (1 = controllable; 4 = uncontrollable)
- **Newness** (1 = old; 4 = new)
- **Chronic-catastrophic** (1 = chronic; 4 = catastrophic)
- **Common-dread** (1 = common; 4 = dread)
- **Severity of consequences** (1 = not fatal; 4 = certainly fatal)

The population of this study was all teachers and administrative staff of primary schools in Beji Subdistrict, Depok City. There were 14 schools that became the research sample, of which seven were public elementary schools and seven were private elementary schools. Meanwhile, to determine the sample size, the total sampling technique was employed; so, all members of the population (i.e., teachers and administrative staff) were taken as respondents.

Data analysis was carried out using the mean rating, which represents the average profile of OHS risk perception. The mean rating is divided into two parts, namely five safety risks and five health risks.

**Results**

The characteristics of respondents from this study were as follows: 51.8% were aged over 39 years; 75.4% were women; 54.8% came from private schools; 94.5% were teachers; 48.8% had worked for more than 10 years; 95.5% held at least a diploma degree; and only 10.1% had attended health and safety training.

Of the five safety risks, being pinched hit or pricked was perceived by school staff as a long-standing risk, often experienced, with an acute effect, only causing
one person to be injured, and not fatal. Falling down the stairs, according to school employees, is the risk most people are aware of; it can be accepted voluntarily and is common and controllable. Thus, this risk does not frighten school employees. Meanwhile, fire is perceived by school employees as the least acceptable risk because it has fatal consequences. Because it is rarely experienced, school employees do not yet perceive the risk of fire as being well known to science or to those exposed to this risk. School employees considered natural disasters as risks that are new, unknown, uncontrollable, and rare, and have delayed effects; they are also perceived to be catastrophic as they can result in many people becoming injured or sick. Just like fire, the risk of natural disasters is considered to have fatal consequences. See Figure 1 for more details.

Meanwhile, of the five health risks, contaminated food is perceived by school employees as the most unacceptable and catastrophic risk. As for exposure to chemicals and hazardous materials, school employees considered this risk to be known, uncontrollable and having the potential to bring fatal effects. Because it is very rare, school employees perceive this risk as not known to science or those exposed to it. On the other hand, school employees regard eye strain as a long-standing, known, and controllable risk because the impact is only felt by one person. This risk is common, so school employees consider it to be known both to science and those exposed to it. A risk that is considered to have a delayed effect is stress due to workload. Meanwhile, noise is a risk that was considered to have a fast or acute effect but with no fatal consequences. See Figure 2 for more details.
Discussion

The results of the analysis of the following risk perceptions are based on the nine dimensions of the psychometric paradigm.

Voluntariness of Risk

In this dimension, we asked employees about their perceptions of the risks that exist in the school environment, especially those related to their work, and specifically whether school employees enter into these risky situations voluntarily. In theory, employees feel forced to do their work and accept risks. The more a person is willing to accept a risk, the lower the level of risk perception. In this dimension, school employees perceive some risks as ones which cannot be accepted or which they are forced to accept if they occur.

Immediacy of Effect

In this dimension, we explore employees’ perceptions of the risks that exist in the school environment, especially to what extent the risk brings immediate or delayed effects. In theory, employees feel that the effect of the risk will occur immediately. If employees perceive that the effect of the risk will be felt right away, it is expected that their level of alertness will increase and they always be careful in carrying out their work.

Known to Exposed of Risk

In this dimension, we asked school employees about their perceptions of the extent to which the risks are known by those who are exposed to them. We further asked whether they know about the risks of their work through their own experience or through others. In this dimension, employees know the risks to their work from their own experience. This is because if someone knows that they will be exposed to a risk because they already have experience of it, then their awareness of that risk will be higher than those with no knowledge of it. In other words, a person who has experienced a risk themselves will have a higher level of alertness.

Known to Science

This dimension explores the extent to which risks are known to science. The researcher wants to find out whether the employees perceive the risks as being known to science (for example from reading, training, formal education, non-formal education, television, events, etc.) or as being not known to science at all. Knowledge of risks is important; individuals who know the risks are more likely to know what action must be taken to deal with existing risks. With this knowledge, employees are expected to be more alert and to have the ability to manage risks in the workplace. Awareness of risk and the ability to avoid risk is expected in this study.

Controllability

This dimension explores to what extent employees can avoid death or the negative consequences of risks, by personal skill, while engaging in their work. The researchers asked employees whether they perceived the risks of their work to be controllable. In this dimension, employees considers the risks to be uncontrollable. In an uncontrollable situation, people will feel helpless. However, people usually overestimate their ability to control a situation and tend to perceive their personal risk as lower than that of others. Based on results, employees feel they can accept almost all risks voluntarily because they are able to control them.

Newness

In this dimension, the researchers asked the employees whether they perceived the risks to be new or old. It is expected that employees consider the risks involved in their work to be newly discovered because there is a tendency for people to be more aware of new risks that have not been experienced before. In addition, if someone is aware of a new risk, they will gradually accept and try to adapt to it. Based on the results, most elementary school employees think that the ten OHS risks of working in a school mentioned in the questionnaire have long existed.

Chronic – Catastrophic

This dimension explores whether the risks experienced by school employees affect one person at one time (chronic) or large numbers of people at once (catastrophic). Employees assume the risks may bring broad effects and can even cause many people to die (catastrophic). Our results show that most employees consider that eight of the OHS risks only cause injury to one person. Meanwhile, the two remaining risks that are considered to be catastrophic are fires and natural disasters.
Common – Dread

This dimension describes to what extent employees can perform risky jobs and think about the risks calmly. Employees feel that the risks of their work are so rare that they are afraid. Someone who is accustomed to an activity risk usually tends to be more willing to accept the risk voluntarily and feels that it is controllable. The more a person fears the effects of a risk, the more likely he/she is to judge the activity as having the potential to cause death.10

Severity of Consequences

In this dimension, we asked the school employees about their perception of the severity of the risks involved in their work and whether they cause injury or even death. The worker considers the risk involved their work to potentially cause severe injury or even death. The severity of the consequences indicates how likely an accident or disease resulting from a risk is to be fatal.1 Additionally, individuals who consider the impact of a risk to be deadly, tend to have higher levels of risk awareness.11

Conclusions

Of the ten OHS risks, most were perceived by the elementary school employees as having long existed, having acute effects, being accepted immediately, and being controllable. The elementary school employees’ knowledge of these ten risks is still scientifically limited. Therefore, school employees require training in OHS, especially relating to the risk of fire and natural disasters. This will mean that the employees will later have the capability to take precautions and conduct sufficient mitigation whenever such risks occur.

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Ethical Approval: This research has been approved by the Research Ethics Commission and Public Health Services Faculty of Public Health Universitas Indonesia through Certificate 340 / UN2.F10 / PPM.00.02 / 2018.

Competing Interest: Nil.

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9. Depok City Health Profile in 2013.


18. Indonesia’s 1945 Constitution.


Validity and Reliability Study of a Semi-Quantitative Food Frequency Questionnaire (FFQ) for Measuring Calcium Intake in Young Adult Women

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Abstract

The semi-quantitative food frequency questionnaire (FFQ) is one of the dietary assessment methods widely used in large scale epidemiological studies. However, its validity and reliability remain debatable because it does not directly measure the quantitative consumption of food. The aim of this study was to evaluate the validity and reliability of semi-quantitative FFQ for measuring calcium intake compared to the weighed food records as a reference method. This study comprises of 54 female with a mean age of 21 years, selected by simple random sampling. There was no statistical difference in the median between two methods based on the Wilcoxon signed rank test (P>0.05). The Pearson’s correlation coefficient between the two methods was significantly correlated (r=0.42 ; P=0.001). The Bland-Altman analysis showed that the mean difference (95% limit of agreement) between the semi-quantitative FFQ and weighed food record was 38.7 mg/day (- 719.52 - 797.03) and had 3.7% degree of misclassification. There was no significant difference between the median of the semi-quantitative FFQ completed twice (p<0.05) and correlation coefficient, as shown by Pearson (r=0.74 (p<0.05). This study concluded that semi-quantitative FFQ was a valid and reliable tool to assess calcium intake in young adult female from different levels of economic background. This method can be used in epidemiological studies and is good enough to find the high-risk individual with a low calcium intake.

Keywords: Semiquantitative FFQ, Food Weighing, Calcium Intake, Validity, Reliability.

Introduction

Calcium intake is essential for maximizing peak bone mass during adolescence until young adults, and osteoporosis delay in the later life. Studies show that adolescent Ca intake in Indonesia is very low, only half of the recommended nutritional adequacy.¹ ² Assessing calcium intake among young adult is essential to plan preventive intervention by identifying those with inadequate intake. Weighed food records is the precise dietary assessment method for estimating food and nutritional intake by reporting detailed amount through the weighing of all the foods and beverages consumed in a day (24 h). This method is accurate and free from recall bias.³ However, this method has relatively high burden on respondents, so the probability of respondent to completes the study tends to be lower than the other method.⁴ Unless they have a high level of nutrition literacy.⁵

Semi-quantitative FFQ as one of the alternative method frequently used in large numbers of subjects. FFQ is the questionnaire containing a list of completed foods and beverages with a standard portion to estimate the amount of food consumed.⁶ However, the validity and reliability of FFQ remain debatable because it does not directly measure the amount of food consumed.

Some studies have evaluated validity and reliability of semi-quantitative FFQ for measuring calcium intake. Montomoli⁷ reported that semi-quantitative FFQ is
a valid tool for assessing calcium intake in young and old female adults. Palacios [8] concluded that the semi-quantitative FFQ was valid compared to the 6 days of 24-hour recall. However, the reference method used in this study has the same limitations as FFQ in terms of depend on memory.

**Methodology**

This validity study was conducted between April and Mei 2018. The estimated calcium intake of the second semi-quantitative FFQ administration was compared to the average calcium intake for the 2 days weighed food records (one day on weekday, and one day on a weekend). The calcium intake of semi-quantitative FFQ completed twice, with a one month interval was also evaluated to determine the reliability. This study includes female Nutrition students from third and fourth year in University of Indonesia 2018 (n=90). The exclusion criteria were those students who performed certain diet program or had a serious illness in the past month.

The total minimum sample was calculated using the correlation coefficient hypothesis test equation, where the reference $r$ value using the Matthys research [7] ($r=0.48$). As minimum of 54 samples were required and simple random sampling was applied. The self-administered semi-quantitative FFQ consists of a list of 53 calcium rich foods with open ended frequency questions.

Another calcium intake collected by weight of the food consumed during two non-consecutive days used the SF 400 scale type with an accuracy of one gram. calcium intake of the two methods was transformed into daily nutrients (mg) using the software programme NutriSurvey (2007). The statistical approach for evaluating validity was the Wilcoxon signed rank test to see the median difference in calcium intake, and the Pearson correlation describe the association of calcium intake between the two methods [10]. Sensitivity is defined as the proportion of those who have the calcium intake below the cut-off (700 mg/day, 800 mg/day, 1000 mg/day and 1100 mg/day) according to the weighed food records, which also falls below the cut-off point according to the semi-quantitative FFQ. The Limit of agreement between the two methods was calculated as recommended by Bland and Altman. A good agreement will show that the mean of the two different methods must be close to zero and the plot is concentrated on the horizontal line $y = 0$. The cross-classification according to the semi-quantitative FFQ with the weighed food records was used to calculate the percentage of respondents who were mistakenly misclassified (the lowest quartile of one method and highest quartile of another method) [4].

Finally, discriminative power of semi-quantitative FFQ was analyzed using surrogate category analysis. If the test method is valid, the differences should be significantly different, and the means should be changed regularly from top to bottom category [4]. The $P$ value of 0.05 was used as the limit of significant results and has been used in a nutritional epidemiological study [11]. All statistical analyses were performed using the IBM SPSS 20 statistics. All participants were provided informed consent then a food frequency request was made in writing and 2 days of weighed food records was completed.

**Results**

A total of 54 female respondents with a mean age of 21.5 completed a semi-quantitative FFQ and two days weighed food records. Respondents had a median calcium intake of 569 mg/day from weighed food record or 51% from the recommended value (1100 mg/day). The median calcium intake was 663.5 mg/day for the semi-quantitative FFQ in the first administration or 60.2% of the recommended daily value, and the median calcium intake for the second administration of the semi-quantitative FFQ was 537 mg/day or 48.8% of the recommended daily value.

The median difference between the second administration of semi-quantitative FFQ and weighed food records was 32 mg/day and did not differ significantly. There was a significant correlation between the semi-quantitative FFQ and weighed food records ($r=0.42, P = 0.001$). The limit of agreement between the semi-quantitative FFQ and the weighed food records shown in Figure 1. The semi-quantitative FFQ had a systematic bias of 38.7 mg/day (limit of 95% agreement) (-719.52 – 797.03 mg/day).

The analysis of the surrogate category in Table 1 shows that the calcium intake quartile of semi-quantitative FFQ has a significant mean increases between the quartiles (ANOVA, $p<0.05$).
Figure 1. Bland Altman Plots Assessing the Agreement between the semiquantitative FFQ and 2 days of food weighing in 54 female nutrition students.

Table 1. Actual values of surrogate FFQ categories (mg/day)

<table>
<thead>
<tr>
<th>Quartile calcium intake (SQ FFQ)</th>
<th>N</th>
<th>Actual value (weighed food record)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean calcium intake ± SD (SE)</td>
<td></td>
</tr>
<tr>
<td>Q1 (&lt;411.5)</td>
<td>13</td>
<td>485.53 ± 275.01 (76.27)</td>
<td>0.026</td>
</tr>
<tr>
<td>Q2 (411.5 – 537)</td>
<td>14</td>
<td>559.73 ± 243.33 (65.03)</td>
<td></td>
</tr>
<tr>
<td>Q3(537.1 – 702.75)</td>
<td>14</td>
<td>619.89 ± 179.84 (48.06)</td>
<td></td>
</tr>
<tr>
<td>Q4 (&gt;702.75)</td>
<td>13</td>
<td>808.34 ± 367.81 (102.01)</td>
<td></td>
</tr>
</tbody>
</table>

There was a significant difference between median calcium intake for the first and second semiquantitative FFQ (P=0.003). Median different of calcium intake was 126.5 mg/day. There was a significant correlation between first and second semiquantitative FFQ. The correlation coefficient was r =0.74, P<0.000. The Bland Altman plot demonstrates that the first administration semiquantitative FFQ tends to overestimate calcium intake by 115.6 mg/day (95% limits of agreement) (-441,388 - 672,625 mg/day (Figure 2).

Table 2. Sensitivity, specificity, positive predictive value and negative predictive value of semiquantitative FFQ in any level of intake.

<table>
<thead>
<tr>
<th>Semiquantitative FFQ</th>
<th>Cut-off calcium intake</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>700 mg/day</td>
</tr>
<tr>
<td></td>
<td>800 mg/day</td>
</tr>
<tr>
<td></td>
<td>1000 mg/day</td>
</tr>
<tr>
<td></td>
<td>1100 mg/day</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>78.9%</td>
</tr>
<tr>
<td></td>
<td>83.7%</td>
</tr>
<tr>
<td></td>
<td>87.5%</td>
</tr>
<tr>
<td></td>
<td>86.5%</td>
</tr>
<tr>
<td>Specificity</td>
<td>37.5%</td>
</tr>
<tr>
<td></td>
<td>36.4%</td>
</tr>
<tr>
<td></td>
<td>33.3%</td>
</tr>
<tr>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>Positive predictive</td>
<td>75%</td>
</tr>
<tr>
<td>value</td>
<td>83.7%</td>
</tr>
<tr>
<td></td>
<td>87.5%</td>
</tr>
<tr>
<td></td>
<td>87%</td>
</tr>
<tr>
<td>Negative predictive</td>
<td>42%</td>
</tr>
<tr>
<td>value</td>
<td>36.3%</td>
</tr>
<tr>
<td></td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>12.5%</td>
</tr>
</tbody>
</table>

The cross classification analysis between quartile calcium intake of two methods shows that semiquantitative FFQ could classify 42.5% of respondents in the same or identical category, and 96% were classified in the same and adjacent category, while 3.7% of the respondents were grossly misclassified. The sensitivity, of the semi-quantitative FFQ are shown in Table 2. The sensitivity and the positive predictive value was > 80% by the 800 mg/day cut off and the highest specificity was found in the cut of 1100 mg/day.
Discussion

The estimated calcium intake did not differ between semi-quantitative FFQ and weighed food records. This result is similar to another study in which the estimated calcium intake did not differ with the reference method [5,6,10]. No statistical difference indicating that there was no significant bias in measurement [2]. Mean that FFQ could be applied to evaluated intervention programs related to dietary Ca intake [9]. The correlation between calcium intake of weighed food records and semi-quantitative FFQ in this study was lower than in some studies [5,10,11,12]. But higher than in other studies [13]. Although this study has a moderate correlation (r=0.4), the reference method used was the most accurate method for estimating dietary and food intake, while other studies used the food records or 24-h recalls as a reference. Morgan et al., [14] also used r > 0.3 as an acceptable limit of validity. The Institute of Medicine used the correlation r = 0.3 until r = 0.7 between the semi-quantitative FFQ and the weighed food records to determine if the semi-quantitative FFQ was applicable for epidemiological studies [15].

Based on the cut-off recommendation level (700 mg/day, 800 mg/day, 1000 mg/day and 1100 mg/day) sensitivity of semi-quantitative FFQ in this study reached >80% for the 800 mg/day cut-off and more. However, in all the cutoff used, the sensitivity remains very low. This study also shows that sensitivity continues to decrease as the cut-off increases. A good relative validity of the dietary assessment method should have at least sensitivity and specificity > 80% [17]. If the test method has a high specificity a high predictive value can obtained[2]. Rarely the dietary assessment method has a high sensitivity and specificity since commonly an increase in one will compromise the other [19]. The sample size used in this study may influence this result because only a view respondent whose calcium intake more than cut-off that contributed to lower specificity and negative predictive value. For this reason, Willet [20] and Magarey et al., [19] suggested using at least 100 sample in the validity study [19,20].

In the cross classification analysis only a few subjects (3.7%) were grossly misclassified. This result is better in term of degree of classification error than other studies [13]. It is enough to establish that semi-quantitative FFQ could differentiate a subject at certain level of intake and determine its validity [4].

Based on the surrogate category analyzed, mean calcium intake of the reference method increased with increasing quartile semi-quantitative FFQ (P<0.05). This result is similar to other studies [7,12,13]. This finding also proves that semi-quantitative FFQ has the ability to provide calcium intake data in epidemiological study related to the risk of disease [7]. Despite there is no standard limit of bias to determine the acceptable bias in the interpretation of Bland Altman Plot. this study still has a close limit of agreement with other studies [8,21]. This study also has a lower mean difference (38.75 mg/day) than in other validation studies and a relatively small amount of less than one serving calcium rich food [19]. However, a wide limit of agreement between the two dietary assessment methods shows that semi-quantitative FFQ cannot be used to assess an individual’s absolute calcium intake. Nevertheless, for epimeiological survey purpose is still acceptable, especially to rank subjects in certain levels of intake [9].

The correlation between the two administration of semi-quantitative FFQ was high r=0.74 (p=0.000). This correlation is close to other repeated measurements of calcium intake semi-quantitative FFQ [8]. Morgan et al., [16] categorized r=0.7 as a strong relationship, which means that the random response errors such as low motivation or unclear questions of the questionnaire are relatively low. The Bland-Altman plot shows that the mean difference between the two administrations was 115.6 mg/day, with a limit of agreement in the range (-441, 388 to 672,627 mg/day). This range of underestimation and overestimation is lower than the limit of agreement between the calcium intake of semi-quantitative FFQ and weighed food records. Moreover, degree of bias (115.6 mg/day) in this study still below a portion of calcium in the high calcium content of calcium rich food.

The reference method for this validation study has an independent source of error with semi-quantitative FFQ. It is important to consider avoiding an overestimation in validity. Other studies used a 24h recall as the gold standard [5,14,21,23]. However the high correlation in calcium intake of the two methods did not ensure a high validity of the test method, since they have the same source of errors. Beside that, the 2 days weighed food records in this study greatly improve the compatibility of the study.
Conclusions

Semi-quantitative FFQ is a valid and reliable alternative tool for weighed food records to estimate the calcium intake of nutrition students in University of Indonesia 2018 and other similar populations. But, there could be biased towards a higher education group, which may not be representative of the Indonesian population.

Ethical approval: The study was approved by University of Indonesia Ethical Committee, Faculty of Public Health with reference number 220/UN2.F10/PPM.00.02/2018.

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Body Length Prediction Using Ulnar Length for Children Aged 0–23 Months in East Jakarta

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Abstract

The body length measurement is important for monitoring the growth and development of children; however, the length is frequently measured incorrectly in children under 24 months old. Errors of 60–70% can be caused by child-related factors, especially their movement. Therefore, surrogate anthropometric measurements are required when the actual body length measurement is unobtainable and/or unreliable.

This cross-sectional study was designed to develop a body length prediction model for children based on the ulna length by using liner regression. From May through June of 2018, eighty-eight boys and ninety-two girls aged 0–23 months old from several integrated children’s health centres in East Jakarta, Indonesia were recruited for this study. The study results showed that there were very strong correlations between the right ulna length and the body length (boys r=0.917, p≤0.005; girls r=0.951, p≤0.005) and the left ulna length and the body length (boys r=0.914, p≤0.005; girls r=0.952, p≤0.005). The equations containing the left ulna length and the age had the lowest standard error of the estimate (SEE) values, and they provided the most reliable length estimations for the boys and the girls (SEE ±1.222 cm and ±1.245 cm, respectively). Further studies with greater sample sizes that better represent each age category are needed in order to produce equations with smaller SEE values.

Keywords: prediction model, length, ulna length, children aged 0–23 months

Introduction

The body length measurement is important for monitoring the growth and development of children, and the American Academy of Pediatrics recommends frequent body length measurements during the first 18 months of a child’s life. [1] Tracking body length increases helps medical professionals to identify health problems early, so they can prevent growth rate slowing; [2] however, in children younger than two years old, the body length measurement is frequently inaccurate. [3,4] Approximately 60–70% of the total length measurement unreliability is due to child-related factors, [5] one of which is body movement. [3,6] The body length is measured while the child is lying down (recumbent) using a length board. [7]

Infants and small children are difficult to measure because of their inability to follow verbal instructions and/or control their body movements, especially if they are temperamental. [8] Some common errors that are made when measuring the length are not having the head in the correct plane, not having the child lying straight along the board, feet that are not parallel with a movable board and not having the board placed firmly against the child’s heels. [9] Measurement inaccuracies can have significant impacts on the diagnosis of growth disorders, resulting in misdiagnoses, [3] so an alternative method for measuring the recumbent body length in children is needed. [1]

Surrogate measurement methods are required when the recumbent body length of a child is unobtainable or unreliable. [10] The ulna length has been used previously to estimate the body length and height of healthy American children aged 0–6 years old (r=0.93), [10] healthy Indian children aged 4–17 years old (r=0.93) [11] and healthy Australian children aged 5–19 years old (r=0.98 in boys and r=0.97 in girls). [12]
Studies using the ulna length to predict the body length in children younger than 2 years old are rare, especially in Indonesia. The use of the ulna length as a potential surrogate body length measurement is not usually impeded by joint deformities,\(^{10}\) not to mention the fact that it is usually easier to obtain and more efficient.\(^{11}\) Therefore, the objective of this study was to develop some predictive models for the body length of children aged 0–23 months old based on the ulna length, which can be used to accurately estimate the body length.

**Materials and Method**

This quantitative study had a cross-sectional design. This study was conducted in several integrated children’s health centres in East Jakarta, Indonesia. The inclusion criteria were children aged 0–23 months old without preterm birth histories. The exclusion criteria were children with fractures, physical deformities or bone abnormalities.

The research instruments used in this study included a length board with an accuracy of 0.1 cm that was used to measure each child’s body length and a non-elastic measuring tape with an accuracy of 0.1 cm that was used to measure the ulna length. Before conducting the interviews related to a child’s identity, the respondents (parents) were asked to fill out an informed consent sheet as a form of agreement to participate in this study.

**Body Length Measurements**

Two examiners were required to correctly position the subject, and to ensure that accurate and reliable body length measurements were obtained. The subject was placed face up, with his/her head toward the fixed end of the board and his/her body parallel to the board’s axis. One examiner applied gentle traction to bring the crown of the child’s head into contact with the fixed headboard, while the second examiner held the child’s feet, keeping the child’s knees straight, and brought the movable footboard to rest firmly against the child’s heels. The reading was taken to the nearest millimetre.\(^{9}\)

**Ulna Length Measurements**

The ulna length measurements of the left and right arms were taken while the child was lying supine or sitting, depending on his/her developmental stage. One examiner was required to measure the ulna length. Using a tape measure, the length was measured in centimetres between the point of the elbow (olecranon process) and the midpoint of the prominent wrist bone (styloid process).\(^{1,14}\)

**Results**

The descriptive statistical results in means, medians and standard deviations for the age, body length, right ulna length and left ulna length are shown in Table 1. All of the anthropometric results were consistently smaller in the girls than in the boys, after adjusting for the age. However, the mean differences in the anthropometric results between the boys and girls were not significant (p>0.05). In addition, there were no significant differences between the lengths of the right and left ulnas (p>0.05).

The correlation coefficients for the body length comparisons between the right ulna and left ulna length measurements are shown in Table 2. All of the measurements showed statistically significant correlations with the body length (p<0.01). The results of the linear regression equations for the body length estimations from the right ulna and left ulna lengths are shown in Table 3. The regression coefficients were significant for all of the parameters.

Tables 4 shows that the combination of the left ulna length and the age was the best body length predictor because it had the lowest SEE. The equations that included the sex variable had higher SEE values (+1.254 cm) than the equations that were categorized by the sex. Tables 3 and 4 show that the multiple regression equations resulted in lower SEE values than the linear regression equations.

**Discussion**

In this study, the means of the body lengths and the ulna lengths were higher in the boys than in the girls. However, the mean difference in the anthropometric results between the boys and the girls was not significant (p>0.05). The higher mean body length measurement value obtained for the boys when compared to the girls was similar to the findings of previous studies.\(^{10,15}\) The insignificant differences in the body lengths of the boys and the girls could have been due to the fact that the study subjects were 0–23 months old. With regard to the body length, boys grow faster than girls immediately after birth, but they also decelerate more, so by 7 or 8 months they actually grow more slowly than girls.\(^{16}\) During the prepubertal period, there is an overall similarity in the linear dimensions between the boys and the girls.
Significant length/height differences between boys and girls occur when they are entering puberty, which is the growth spurt period. The growth rate of girls reaches its peak at 12 years old, while the growth rate of boys reaches its peak at 14 old. In boys, the growth spurt duration is longer and the growth rate is faster than they are in girls.

The correlation coefficients between the body length and the ulna length in both sexes were found to be statistically significant (p<0.01), indicating strong positive correlations between these parameters. The strong correlation coefficient values between the body length and ulna length have also been shown in previous studies of healthy American children aged 0–6 years old (r=0.93), healthy Indian children aged 4–17 years old (r=0.93) and healthy Australian children aged 5–19 years old (r=0.98 for the boys and r=0.97 for the girls).

The results of this study showed that the equations consisting of the left ulna length and the age with the lowest SEE value would provide the most reliable length estimation in the boys and the girls. They showed that the ratios of the ulna length to the body length changed considerably with the age and sex, and that the equations that consisted of these variables yielded more reliable results. Moreover, according to the validation criteria recommended by Lohman et al., the SEE of the valid prediction equation should be <3.5 cm with an R²>0.7. All of the equations in this study met those criteria. The equations that had the lowest SEE values and the highest R² that consisted of the left ulna length and the age. The involvement of the age variable and the separation of the formulas based on the sex were in accordance with the World Health Organization guidelines stating that the anthropometric data of children should be distinguished by the age and the sex. Despite the high accuracy in the body length prediction by these surrogate measurements, caution should be exercised when using surrogate measurements for estimating the body length in the individuals in this population because a 1.222-cm or 1.271-cm difference could potentially alter the clinical assessment or the nutritional status of children.

This study did have some limitations, one of which was the limited amount of anthropometric data. Previously, we planned to include a number of samples from each age and sex category so that the groups would be similar. However, due to the limited number of subjects, there were inequalities in the sample numbers from each age category, which limits the generalizability of our findings.

Table 1. Descriptive statistics: age, body length, right ulna length (cm), and left ulna length (cm) in boys, girls and both sexes

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Min-Max</th>
<th>p-value&lt;sup&gt;a&lt;/sup&gt;</th>
<th>p-value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (month)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>88</td>
<td>10.47</td>
<td>10.50</td>
<td>6.363</td>
<td>0-23</td>
<td>0.49*</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>10.45</td>
<td>11.00</td>
<td>6.308</td>
<td>0-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Sexes</td>
<td>180</td>
<td>10.46</td>
<td>11.00</td>
<td>6.317</td>
<td>0-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Length (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>88</td>
<td>72.04</td>
<td>72.45</td>
<td>8.240</td>
<td>55.0- 88.2</td>
<td>0.75*</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>69.80</td>
<td>71.50</td>
<td>8.340</td>
<td>52.3-84.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Sexes</td>
<td>180</td>
<td>70.89</td>
<td>72.15</td>
<td>8.344</td>
<td>52.3-88.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Ulna Length (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>88</td>
<td>10.94</td>
<td>10.80</td>
<td>1.377</td>
<td>8.20-14.1</td>
<td>0.97*</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>10.47</td>
<td>10.70</td>
<td>1.341</td>
<td>7.40-13.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Sexes</td>
<td>180</td>
<td>10.69</td>
<td>10.70</td>
<td>1.375</td>
<td>7.40-14.1</td>
<td>0.24*</td>
<td></td>
</tr>
<tr>
<td>Left Ulna Length (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>88</td>
<td>10.93</td>
<td>10.80</td>
<td>1.372</td>
<td>8.20-14.1</td>
<td>0.94*</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>10.47</td>
<td>10.70</td>
<td>1.349</td>
<td>7.40-13.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Sexes</td>
<td>180</td>
<td>10.69</td>
<td>10.70</td>
<td>1.376</td>
<td>7.40-14.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Difference between boys and girls. <sup>b</sup>Difference between right and left ulna length; *Not significant (p value>0.05)
Table 2. Correlation between length and length of the right-ulna and left-ulna in boys, girls, and both sexes

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>p-value</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Ulna Length (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>88</td>
<td>0.000</td>
<td>0.917</td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>0.000</td>
<td>0.951</td>
</tr>
<tr>
<td>Both Sexes</td>
<td>180</td>
<td>0.000</td>
<td>0.935</td>
</tr>
<tr>
<td>Left Ulna Length (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>88</td>
<td>0.000</td>
<td>0.914</td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>0.000</td>
<td>0.952</td>
</tr>
<tr>
<td>Both Sexes</td>
<td>180</td>
<td>0.000</td>
<td>0.934</td>
</tr>
</tbody>
</table>

Table 3. Linear regression equations for body length estimation (cm) from right ulna length and left ulna length (cm) in boys, girls, and both sexes

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Equation</th>
<th>R square</th>
<th>SEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Ulna Length (cm)</td>
<td></td>
<td>BL= 12.071+5.484RU</td>
<td>0.841</td>
<td>±3.308</td>
</tr>
<tr>
<td>Boys</td>
<td>88</td>
<td>BL= 7.842+5.916RU</td>
<td>0.905</td>
<td>±2.581</td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>BL= 10.182+5.675RU</td>
<td>0.875</td>
<td>±2.963</td>
</tr>
<tr>
<td>Both Sexes</td>
<td>180</td>
<td>BL= 10.036+5.489LU</td>
<td>0.835</td>
<td>±3.364</td>
</tr>
<tr>
<td>Left Ulna Length (cm)</td>
<td></td>
<td>BL= 8.239+5.882LU</td>
<td>0.906</td>
<td>±2.577</td>
</tr>
<tr>
<td>Boys</td>
<td>88</td>
<td>BL= 10.349+5.662LU</td>
<td>0.872</td>
<td>±2.990</td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>BL= 10.349+5.662LU</td>
<td>0.872</td>
<td>±2.990</td>
</tr>
<tr>
<td>Both Sexes</td>
<td>180</td>
<td>BL= 10.349+5.662LU</td>
<td>0.872</td>
<td>±2.990</td>
</tr>
</tbody>
</table>

BL= Body Length (cm), RU= Right Ulna Length (cm), LU= Left Ulna Length (cm), R square= coefficient of determination, SEE= standard error of estimate

Table 4. Multiple regression models for length estimation (cm) from right ulna length (cm), left-ulna length (cm), and age in boys, girls, and both sexes

<table>
<thead>
<tr>
<th>Sex</th>
<th>Equation</th>
<th>R</th>
<th>R square</th>
<th>SEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>BL= 41.657+1.907RU+0.911A</td>
<td>0.989**</td>
<td>0.977</td>
<td>±1.249</td>
</tr>
<tr>
<td>Girls</td>
<td>BL= 33.524+2.694RU+0.772A</td>
<td>0.989**</td>
<td>0.978</td>
<td>±1.252</td>
</tr>
<tr>
<td>Both Sexes</td>
<td>BL= 38.539+2.248RU+0.852A-1.182S</td>
<td>0.988**</td>
<td>0.977</td>
<td>±1.271</td>
</tr>
<tr>
<td>Boys</td>
<td>BL= 41.588+1.911LU+0.914A</td>
<td>0.989**</td>
<td>0.978</td>
<td>±1.222</td>
</tr>
<tr>
<td>Girls</td>
<td>BL= 33.661+2.683LU+0.771A</td>
<td>0.989**</td>
<td>0.978</td>
<td>±1.245</td>
</tr>
<tr>
<td>Both Sexes</td>
<td>BL= 38.592+2.242LU+0.854A-1.180S</td>
<td>0.989**</td>
<td>0.978</td>
<td>±1.254</td>
</tr>
</tbody>
</table>

BL= Body Length (cm), A= Age (month), S= Sex (0 for boys;1 for girls), RU= Right Ulna Length (cm), LU= Left Ulna Length (cm); **Significant (p value<0.01)
Conclusion

The ulna length can serve as an accurate and reliable surrogate measure of the body length in healthy children aged 0–23 months. The prediction equations from this study that used the ulna length, age and sex could be good for estimating the body length when the actual body length measurement is unobtainable or unreliable due to a lack of patient cooperation or joint deformities. The equations consisting of the left ulna length and the age that were distinguished by the sex had higher accuracy levels when they were used to predict the body length. Despite the high body length prediction accuracy of these surrogate measurements, caution should be exercised when using surrogate measurements for estimating the body length of an individual, because a little difference could potentially alter the clinical assessment or nutritional status of children aged 0–23 months old. Further studies with an adequate number of subjects from each age category are needed to reduce the variability and obtain more accurate equations with lower SEE values.

Ethical Approval: This study received ethical approval (number 219/UN2.F10/PPM.00.02/2018) from the Committee of Ethics Research and Community Services, Faculty of Public Health, University of Indonesia.

Competing Interests: The authors declare that there are no conflicts of interest with regard to this research study and it was self-funding by the authors.

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References


Dengue Surveillance Information System: An Android-Based Early Warning System for the Outbreak of Dengue in Padang, Indonesia

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¹Ministry of Health Republic of Indonesia, ²Faculty of Public Health, Universitas Indonesia

Abstract

The morbidity and mortality rate of Dengue Hemorrhagic Fever (DHF) causes social and economic impacts. Dengue prevention efforts have not been effective in reducing the incidence of DHF. This research aims to design and develop a prototype early warning system for DHF. This prototype is designed to determine the potential risk of DHF in Padang City.

Method: System development in this research uses the Systems Development Life Cycle (SDLC) method of rapid application development with a choice of prototyping system models. Result: Information system development is done by the surveillance of puskesmas and health cadres who perform system input. Presentation of the information is in the form of tables, charts, and maps showing the situational risk of DHF in the work area of Padang. This information system can be accessed online via smartphone or computer. In conclusion, the development of the DHF awareness information system can facilitate decision making and planning in the Padang City Health Office.

Keywords: DHF, surveillance, Android, smartphone, early warning systems

Introduction

The dengue control system is important in eliminating DHF. Currently vector control is a fairly effective method of fighting mosquito populations¹². In addition, knowledge of environmental management practices can strengthen the capacity of the health system¹. The global spread of dengue fever is related to changes in human behavior, especially the expansion of large urban centers, which supports the proliferation of Aedes aegypti⁴.

The DHF cases in Padang City, in 2015 there were 1,126 dengue cases, CFR about 0.71% and larva free numbers of 60%, while in 2016 there were 911 dengue cases, CFR about 1.21% and Larva free numbers about 75%². The larva free number as an indicator of mosquito breeding conditions were below the target set by the Ministry of Health. The topograph of West Sumatra is located along the coast of the island of Sumatra, consisting of 19 districts and cities. The climate of West Sumatra is classified as tropical, with an average temperature of 25°C. The districts and municipalities with the highest DHF cases are Padang, Pesisir Selatan Regency and the Tanah Datar District Regency. Research in Santiago de Cuba during the 1997 dengue epidemic is also showed human behavior plays a role in increasing the risk of dengue⁵.

This research aims to have data collection performed and input by DHF managers in health facilities and training cadres up to the Rukun Warga (RW) to use an Android device for mobile collection data. DHF control is an important factor in eliminating DHF globally. Currently vector control is an effective method of fighting mosquito populations⁶. Some vector control methods include physical and mechanical control, use of biotic agents, and chemically. In addition knowledge is needed about environmental management practices⁷, strengthening of health system capacity⁸, immunization of vulnerable populations aged 9 - 45 years⁹, social mobilization, and increasing early awareness of the threat of new outbreaks¹⁰. Other studies suggest that
predictive DHF risk maps are needed to identify high risk areas\textsuperscript{11}.

**Method**

The research method is operational research uses SDLC method to build information systems and conduct in-depth interviews to define user requirement.

The main entities involved in the development of the early warning information system for dengue fever are shown in figure 1.

![Figure 1. Entitas of the early warning system](image)

Based on figure 1, the source entity (input) consists of puskesmas and cadres. Data entittas are processing and analyzing data from the source entity to then present data as information that has value. This data is processed through a system developed for early dengue alertness. The output entities are the Padang City Health Office, Mayor and Padang City Government, West Sumatra Provincial Health Office, and the Ministry of Health. The output entities will receive the information that has been processed.

A method to gather information for the development of the DHF early warning system is conducting in-depth interviews to learn about the knowledge and perceptions of the current system. The participants in this interview were officer from the disease control and prevention section, the DHF program manager at the health office, and the puskesmas officer. The information collection instruments were interview guidelines, checklists, and a list of documents for system development activities.

![Figure 2. Prototyping the development system for DHF](image)

Planning is a significant part of the process to discover the main factors in building a system (figure 2). Planning consists of 2 steps, namely initiation activities (technical, economic, and organizational feasibility) and planning management. This can include analysis, identification of the use and utilization of the system, and the system work process starting from the input to processing and output to the information system. The design phase is used to decide how the system will be run, such as hardware, software, and network infrastructure. At this stage a physical design of an information system was developed which supports the early warning system for DHF.

This information system will be used by health workers who will be trained to use the system properly. The technology used in this training is an open source smartphone application. Training is provided through discussion and practicum. The results will be presented at the end of the training implementation. This program is an ongoing activity, and the participants trained will be Training of Trainers (ToT) at their health centers for other programs as well including the use of a Global Positioning System (GPS) and Google Maps for the larva monitoring officer in the field plotting points of cases of the disease.

**Results**

Data from the Padang City Health Office shows that the number of existing health workers do not meet the current need. The ratio of general practitioners to 100,000 residents in Padang is 26. While the ratio of midwives to 100,000 of the population is 85. The ratio of nurses to 100,000 residents in Padang is 237, while the target ratio of doctors, midwives and nurses to the population is 41, 104 and 162.4 per 100,000 of the population, respectively\textsuperscript{12}.

**Identification of Information System Needs**

Input can be done at any time as it can be accessed online via smartphone or web browser. Information can be provided as needed by the user in a DHF situation up to the RW neighborhood in Padang, making it easier for health offices and health facilities to provide interventions in high risk areas for DHF.

Based on the results of in-depth interviews with the Health Office and puskesmas, DHF reporting was carried out in two ways, manually and computerized.
The case report format is in accordance with the recommendations of the Ministry of Health. The management of DHF programs in Padang is carried out actively and passively by health workers and through community empowerment. With computerized systems in dengue control programs and health centers, health authorities already have the necessary hardware. This hardware can also be used as a server for the development of information systems in the health department. The availability of local area networks (LAN) and wireless fidelity (WiFi) in health services is needed.

This system was developed based on the DHF reporting and surveillance system currently available, and as a result the program managers in both the puskesmas and the Health District Office have not difficulties in maintaining the system. This system is designed not only for DHF managers, but also cadre participation as a form of community empowerment. The output of this system will not only provide curative information, but also explain promotive and preventive activities carried out in the community.

Database Design

The database design in the DHF early warning information system at the City Health Office of Padang is compiling a new system using MySQL, a multithreaded and multi-user software. This software can be used for the DHF early warning system in Padang. Development is adjusted to the Padang City Health Office as a users, and the system of recording and reporting on pre-existing DHF control programs. The database for the DHF early warning information system can be accessed online and it is intended to store data, manage, and present information related to DHF for users and policy makers within the Padang City Health.

The presentation of information is in the form of graphs, tables, and maps. The use of graphics aims to make the information easy to read and understand. The use of tables is to facilitate decision making and planning, while mapping makes it easier to see the data distribution of DHF risk areas in Padang.

Implementation

The health officers in the information system were DHF cadres in Padang, half of whom were diploma graduates and most of whom had used Android as an operating system on their mobile phones. The cadres were graduates with a health diploma and also volunteers at the puskesmas. The participants were able to run applications using their mobile phones to enter initial data for the system requirements. Most of the cadres also began to use the information system to send their monthly reports to the puskesmas.

Information is provided as needed by the health center and the Health Office. The health office and health facilities can provide interventions in areas at risk for dengue. The information presented in the form of graphs, tables, and maps is simple, detailed, and easy to understand. The resulting information is in real time and can be immediately downloaded when requested.

Discussion

The development of the DHF early warning information system received full support from users both in the Padang City Health Department and the health center network. The information system design developed at the Padang City Health Office is an integrated system to support early warning for DHF. The collection of input data is carried out by DHF managers and cadre managers up to the Rukun Warga (RW) area in Padang through an Android device (mobile data collection). Research in Indramayu shows the main strategies of disease control and dengue are increasing the amount resources needed. This information system is expected to support health planning related to dengue fever in Padang.

Development of the DHR early warning information system simplifies and speeds up data processing compared to doing it manually. The system is a set of interrelated and integrated elements that have a set of subsystems, components or elements that work together and are intended to achieve a single goal and produce a predetermined output. The presentation of information using the DHF early warning information system is carried out in an automated manner by the system. With the presentation of automated information it can facilitate evaluation, determine interventions and policy making by leaders.

Dengue hemorrhagic fever surveillance is the process of collecting, processing, analyzing, and interpreting data, as well as disseminating information to program providers, agencies, and related parties systematically and continuously regarding DHF conditions that could influence the occurrence and transmission of the disease,
so control measures can be taken. Therefore, data input to the system is carried out by puskesmas officers and larva monitoring cadres formed in each village besides that there are also records carried out in hospitals.

Data processing using information systems can be done quickly to create information from the data input by puskesmas and cadres. This data management is part of routine recording. Routine data is data collected through a standard procedure which is clearly defined and implemented with the same frequency at all times. Input quality will indirectly affect the quality of the output produced. Efforts to develop routine data information systems are carried out by making changes in the recording process. The development of routine information system performance measurement is done using performance diagnostic tools, overview tools, office checklists, management assessment tools, and organizational and behavioral assessment tools.

Mobile-based health data collection is used due to the lack of evidence-based data in developing countries, causing difficulties for decision makers in health management. Currently mobile digital platforms such as smartphones and tablet computers are increasingly used for data collection, including health data. These devices incorporate many PC functions including data transmission, surfing the web, transmitting email and instant messaging, displaying digital content, and exchanging data.

The utilization of mobile technology reduces the difficulty in collecting data directly from the public and the districts during an incident. Mobile-based data collection can proactively improve data delivery in real time, although there are still some obstacles. These include officers’ concerns whether their performance is monitored by the leadership, and the number of users who understand mobile technology. Other constraints that have a significant influence on the acceptance and use of mobile health data in developing countries are individual characteristics, processes, and technological factors.

Community participation can be involved in controlling dengue cases but requires a long process, patience, and vector control efforts such as doing health promotion in their environment. Counseling about vectors and control methods is still necessary in the community on an ongoing basis. There is a cadre of larva (Jumantik) monitors who are housewives or larvae monitoring students who can carry out their activities routinely in an effort to control DHF programs.

Research on the use of information systems for early warning can account for the low level of community participation in DHF control. Research on community participation in Makassar found that most respondents (68%) showed low participation rates. With the existence of this system, it is expected that community participation will improve as the technology will help in reporting the incidence of DHF.

**Conclusion**

Early warning systems for DHF online make it easy to obtain necessary information at any time. Such information can be utilized by the health office to conduct monitoring and evaluation in accordance with the conditions in the field. Interventions can also be made based on information available by region. The mobile health data collection improves the management of health information systems through organizational resources, improving information quality (timely, consistent, and complete), organizational efficiency, and creates new possibilities for institutional health data collection.

**Recommendation**

Further development of the DHF early warning system is through the ability to input data offline and being able to involve hospital officials as input workers in the field. The need for integration with the applications at e-health centers, especially for recording cases and deaths due to DHF, is necessary so the DHF early warning system in Padang does not stand alone.

**Financial support and sponsorship**

We would like to thank the Padang City Health Office and the Directorate of Research and Community Service of the Universitas Indonesia. Number of ethical approval is 245/UN2.F10/PPM.00.02/2018 taken from ethics commission for research at the Faculty of Public Health, Universitas Indonesia.

**Conflicts of Interest:** There are no conflicts of interest (nil)

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The Role, Relevance, and Potential of Comprehensive Primary Healthcare in the Indonesian Health System

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²Directorate of Family Health, Ministry of Health, Indonesia

Abstract

The Indonesian government has significantly improved its health system in the last three decades and has made significant efforts to provide health services to the Indonesian population. However, the health status of the population varies due to different socio-economic circumstances. Disparities in health outcomes exist between urban and rural areas and the western and eastern parts of the country. Implementing a health system based on comprehensive primary healthcare (CPHC) will significantly improve the health of the Indonesian population because this approach includes participation of empowered communities and multi-sectoral action in addressing the determinants of health.

This paper aims to describe the implementation of CPHC, discuss the barriers to and enabling factors for its implementation, and highlight the benefits of implementing CPHC in Indonesia.

A systematic search strategy was applied to various databases to obtain the facilitating and constraining factors in relation to the implementation of CPHC.

The national health development programme in Indonesia is based on the concept of primary healthcare, with Puskesmas (community health centres) as the core health service facilities. Some challenges noted for the potential implementation of CPHC include geographical disparities, demographic and epidemiological transitions, decentralisation, inadequate resources and technology, poor health financing, poor community participation, and low levels of empowerment. Measures need to be taken to support the implementation of CPHC, including increasing the capacity of local government; defining clear roles of public, private, and voluntary workers; defining clear roles of civil society; maintaining a high level of political commitment to sustaining community health facilities; having the appropriate technology; improving the capabilities of community health workers; and collaborating with private sectors.

Keywords: comprehensive primary healthcare; Indonesia; barrier; enabling

Introduction

Primary healthcare (PHC) is a “community-based service based on the social model of health, guided by principles of equity, acceptability, cultural competence, affordability, and universalism, and a commitment to community and health development” [1]. The approaches of PHC are both selective and comprehensive. The selective PHC approach is concerned with curative actions aimed at improving the health outcomes of individuals with the associated high costs [2]. In contrast, the approach of comprehensive primary healthcare (CPHC) cures diseases and works toward diseases prevention, health promotion, community participation, and multi-sectoral collaboration to address the social determinants of health (i.e., poverty, housing, employment, working conditions, and diet) [3]. Thus, implementing a health system based on CPHC will improve general population health status. Indonesia had developed different forms of CPHC in certain areas, where community health centres provided both medical

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services and preventive treatment.

Indonesia has significantly improved its health system in the last three decades, manifested in the increasing life expectancy of its population and decreasing infant mortality rates [4]. Additionally, the government has implemented significant measures such as distribution of health workers in all regions to provide health services to its population. However, disparities in health outcomes exist between urban and rural areas and the western and eastern parts of the country. Varying geographic conditions and the disproportionate distribution of social and economic development means that populations in both rural and eastern Indonesia are disadvantaged regarding their access to health services [5]. The burden of diseases, both non-communicable diseases and communicable, also presents challenges [6].

This paper will focus on the implementation of CPHC in Indonesia. The barriers and enabling factors to the implementation of this approach will also be discussed. Finally, this paper will highlight the potential benefits of implementing CPHC in Indonesia.

**Method**

A systematic search strategy of various databases will be conducted to obtain facilitating and constraining factors in the implementation of CPHC in Indonesia through online journal databases, including PubMed, Medline (Ovid), Scopus, ProQuest, Web of Science, PsyInfo and Google Scholar, as well as the websites of the Ministry of Health (MoH) of Indonesia and the World Health Organization (WHO).

**Results and Discussion**

**Comprehensive Primary Healthcare**

CPHC is a developmental process that works to alleviate social inequalities affecting the health status of a population [7]. It works with poor and disempowered communities by developing general health infrastructure and community development strategies. These strategies combine health services, community participation, and inter-sectoral collaboration as the components [8].

The national health development programme in Indonesia is based on the concept of PHC, with community health centres (Puskesmas) being the core health service facilities. The Puskesmas at a sub-district level focuses on six areas: health promotion, infectious disease prevention, outpatient care, mother and child healthcare, community nutrition, and environmental health. Additionally, Puskesmas empower communities to contribute to the health sector [9].

**The Implementation of Comprehensive Primary Healthcare**

A number of challenges have been noted for the potential implementation of CPHC in Indonesia. These challenges will be described in detail.

**Geographical Disparities**

Disparities in health outcomes between members of the Indonesian population are challenging. The Regional Autonomy Watch found that roads, street lighting, water, electricity, and telecommunication were worst in the eastern provinces of the nation [10]. Moreover, in rural Indonesia, most of the population live in poverty. Consequently, rural areas and the eastern parts of Indonesia have limited access to healthcare.

Appropriate infrastructure is one of the most significant elements in the implementation of CPHC. Furthermore, Kaye and Novell revealed that the development of health infrastructure enables uninterrupted service delivery and means that individuals who are identified as high-risk can be treated [11]. Ultimately, CPHC will help strengthen the health system by increasing its equity, efficiency, effectiveness, and responsiveness.

**Demographic and Epidemiological Transitions**

Since the 1980s, Indonesia has undergone a demographic transition: the population is now living for longer, and fewer children are dying. This has been followed by an epidemiological transition that has led to a health transition, where the dominance of communicable diseases have reduced, to be replaced by the dominance of non-communicable diseases [6]. Consequently, the demand for health services has increased.

It has been argued that the Indonesian health system is slow in responding to changing disease patterns caused by demographic and epidemiological transitions [12]. Thabrany asserted that the Indonesian health system has neglected controlling the risk factors of non-communicable diseases [13]. Thus, the curative care of non-communicable diseases will prove to be a financial burden on the health system. By strengthening
CPhC, which is concerned with health promotion and prevention, the finances of the national health system will not be burdened by curing these preventable diseases.

**Decentralisation**

Decentralisation has a significant impact on the potential for increasing the scope of participation, democratising wealth, and improving the delivery of services. Decentralisation was introduced to Indonesia in 2001. It saw the transfer of decision-making and the responsibility of delivery services from central to local governments. However, the Organization for Economic Co-operation and Development found that a lack of coordination between central, provincial, and district levels has slowed the process. Moreover, the roles and tasks of these key stakeholders were not clearly declared in the regulations.

Heywood and Choi found that there was a minor improvement in the use of maternal and child health-services after decentralisation. They found that there was an association between the low utilisation of health services, low achievement of health indicators, and low quality of health services. Low capacities of human resources and lack of administrative and managerial of local authorities at district level were also asserted as barriers to the implementation of a decentralised management system.

**Resources and Technology**

The number of health personnel has increased significantly in the last decade, but the ratio of medical doctors to the country’s population is still under the ideal ratio recommended by the WHO. The MoH found that more than 50 percent of Puskesmas in remote areas were without physicians. Likewise, the percentage of other health personnel is low in remote areas. Moreover, the implementation of task shifting from physicians to nurses has been found to be difficult due to a lack of legislative support.

Community-based health workers make a significant contribution to PHC by bridging the distance between health programmes and the wider community. In the village level, Indonesia has village volunteers or health cadres who have already trained with health knowledge and skill to assist health programmes in the community.

However, programme outcomes are difficult to monitor because the data management is conducted manually. Since the recording and report (R&R) system consists of complicated multi-column forms, many cadres find it difficult to fill them in. Consequently, the form is usually sent in late to the Puskesmas, and this affects the responses and interventions for the patients. Therefore, designing the R&R system to make it more usable for volunteer workers and implementing training programmes to improve their capabilities in recording and reporting will significantly improve the R&R and make it a viable method of monitoring patients.

**Health Financing**

Since decentralisation, the local government has had substantial power over areas of the health service and its workers. However, controlling the finances of the health system for the poor remains the responsibility of the central government. In 2014, Indonesia implemented a national health insurance programme (Jaminan Kesehatan Nasional) (JKN).

The JKN has broken down some financial barriers faced by the poor in relation to health. The utilisation of healthcare in the Puskesmas and hospitals has increased. As a consequence, most of the budget allocated to the JKN is used for medical care services and health infrastructure to support services. However, not all of the population is covered by the JKN: the unemployed and those who work in informal sectors remain outside its cover. Thus, the JKN needs to be expanded by collaborating with private sectors to make PHC accessible in assessing their needs and organising strategies to meet those needs and organising strategies to meet those As previously mentioned, the Posyandu are committed to lowering infant mortality rates and supporting the family planning programme, which was established on June 29, 1983. The Posyandu are community-based services that improve women and children’s health outcomes. They generally located in the villages, open once a month, and are under the operation of the community. They provide health services included immunisation, infectious-disease prevention, and health education. The workers at Posyandus are volunteers and health cadres who are chosen by the community. The health cadres help distribute iron tablets and disseminate information about pregnancy and childcare. They support lactating mothers and provide information about contraception, breastfeeding, and personal hygiene.
of them have completed secondary school.

**Community Participation and Empowerment**

Community participation is necessary to attain a sustainable and effective health programme [3]. Indonesia has applied the PHC approach through community participation. Indonesia has community-based primary health services called Posyandu, especially for the health of the women and children at village level which was established in 1983 [22]. The workers at Posyandu are volunteers and health cadres who are chosen by the community. The Posyandu contributed significantly to increased access to and coverage of maternal and child health services [20].

However, following its launch, the activities of the Posyandu have been inconsistent. During the economic crisis of 1997, the percentage of pregnant women and children who visited the Posyandu and the participation of female cadres decreased significantly [23]. Following the crisis, the MoH revitalised the Posyandu programme. However, the Posyandu need to be improved to enhance their overall quality of services.

In 2005, the MoH launched a health programme entitled Desa Siaga (Alert Village). In 2011, it was strengthened and renamed the Desa Siaga Aktif (Active Alert Village). Community empowerment was the main component of this programme, which encouraged all villages and community members to proactively participate in health development. However, Hill et al. found that the funding to implement this programme has not been ensured by decree, so the operational budget for the Desa Siaga Aktif depends on village administration, local private sectors, mass organisation, and community resources [24]. Therefore, allocating sustainable funding from local authorities and the community to implement the Desa Siaga Aktif is necessary for its survival.

The Potential of Comprehensive Primary Healthcare in Indonesia

To support the implementation of CPCH, it is important to strengthen the capacities of the central and local authorities. Moreover, stipulating regulations to clearly define the roles of public, private, and voluntary workers is necessary. The central government must intervene to provide what is necessary for the implementation of CPCH: increased resources, trained local authority staff, and improved e-government tools [15].

The growth of the Posyandu needs to be sustained by maintaining high levels of political commitment. Furthermore, the appropriate technology should be developed and consistently employed to support health community programmes. Leimena asserted that to improve the capability of community health volunteers in supervising and operating Posyandu, more training needs to be provided [20].

By implementing JKN, the utilisation of health services increased significantly, although health coverage is mostly used for medical intervention instead of promotive and preventive intervention. However, there is a significant relationship between the escalated availability of PHC, higher levels of patient satisfaction, and a decrease in healthcare expenditure. Furthermore, Baum asserted that health systems based on CPCH are highly cost-efficient and cost-effective [8]. Thus, it is essential to invest heavily in prevention to ensure a sustainable JKN. Moreover, the government needs to strengthen its collaboration with the private sector and expand the outreach of JKN so that the entire population of Indonesia can be covered under the scheme.

Ultimately, future studies that focus on the innovation of PHC to support the health system should be undertaken to improve CPCH. However, policies should also be more research-based so as to achieve an improved impact on health outcomes for all of the population.

**Conclusions**

To achieve and maintain health and general well-being, it is insufficient to only focus on areas of health such as promoting medical intervention. Instead, social, economic, and political factors as well as the structural drivers that impact on poor health outcomes should be considered. Using only a selective PHC approach will not impact significantly on addressing the determinants of health. Therefore, the CPCH approach is more suited to work towards social changes that will then affect health status.

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Ethical Clearance: The author declares that there is no ethical clearance needed since data, documents or records for this research are all publicly available.

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Risk Factors of Near-Miss Road Traffic Incidents among Inter-Provincial Public Van Drivers in Thailand

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Abstract

Background: Public vans have higher road traffic accidents (RTAs) compared to other types of public transportation. There is evidence that the chance of RTAs increase with near-miss incidents. Therefore, this study aims to determine the prevalence and risk factors of near miss road traffic incidents among inter-provincial public van drivers in Thailand. Method: This is a Cross-Sectional survey design. The sample consists of 379 public van drivers in Bangkok Bus Terminals selected by proportionate stratified random sampling. The data was collected by an interview questionnaire. Data was analyzed using descriptive statistics and simple and multiple Logistic Regression analyses. Results: The prevalence of road traffic near misses was 38.3 percent. It was found that more working experience (OR adj = 0.30, 95% CI: 0.11-0.77), longer working hours (OR adj = 2.83, 95% CI: 1.34-5.95), violation driving behavior (OR adj = 1.11, 95% CI: 1.01-1.21), smoking (OR adj = 1.65, 95% CI: 1.02-2.66), and poor sleep quality (OR adj = 3.36, 95% CI: 1.22-9.23) were the risk factors of near miss road traffic incidents. Conclusion: The research findings recommend the authorized organizations set up hours of operation and allocate timetables for public van drivers to allow for adequate rest. Promoting safe driving behaviors and smoking cessation among public van drivers should be intervened in order to prevent the occurrence of near miss incidents which in turn could reduce the impacts from road traffic accidents.

Keywords: near-misses, road traffic incidents, public van drivers, road accidents

Introduction

Road traffic accidents (RTA) are a burden on health and an important issue for all countries around the globe. Approximately 1.25 million people die from road traffic accidents each year and more than thirty thousand of the world’s populations are injured each day in road traffic accidents1. Recently, the United Nations has set a global policy and strategy to reduce the problem of road traffic accidents by announcing the years of 2011 to 2020 as the ‘decade of road safety’. According to the Global Status Report on road safety in 2013, Thailand was one of the top five countries that had the highest rate of road traffic accidents and the first rank in Asia, and in ASEAN1 with the world’s second highest death rate2.

According to the data from the health department, accidents from land transport was one of the first five causes of death in Thailand, of which the death rate is 22.3 people per one hundred thousand people3. Furthermore, it was reported that passengers on public vans had the highest number of fatalities and injuries4. Recently studies investigated the cause of accidents involving public transportation and found that driver factors such as sleepiness at the wheel, high speed driving, and cutting off other vehicles in a near hit range5,6 were associated with road accidents.

There is evidence that near-miss incidents are associated with road traffic accidents. A study by Powell...
et al. found that drivers who had experienced a near-miss sleepy accident had a 1.13-fold chance of road traffic accidents. It could be seen that a near-miss incident is an interesting issue because it led to road traffic accidents that brought about property damage, injury, and death. However, little is known about the prevalence and risk factors of near-miss road traffic incidents of public vans. Therefore, this study aims to estimate the prevalence and determine risk factors related to near-miss driving incidents among public van drivers at Bangkok Bus terminal, Thailand.

Materials and Method

Study design and population

This is a Cross-Sectional survey research. The study population was 6,883 public van drivers of the Transport Company Limited that registered with the Department of Land Transport at three mass transit bus terminals in Bangkok including; North and Northeastern Bus Terminal, Southern Bus Terminal, and Eastern Bus Terminal. The eligibility criteria of this study were adults aged 22 years and older, had at least 1 years of public van driving experience with valid public vehicle driving license, and had sufficient level of education to be able to communicate with researchers. Data was collected between February and May 2018.

Sample size and sampling method

Sample size was calculated using the Daniel’s prevalence formula with a 95% level of confidence, 0.05 precision, 0.5 expected prevalence, and at least 364 samples were needed. To compensate for at least 5% potential loss, 379 samples were recruited to study using proportionate stratified random sampling method.

Data collection

Data was collected using an interview questionnaire.

Dependent variable

Near-miss road traffic incident in the past year was assessed by applying a question regarding near-miss incidents of motorcyclist study in Iceland. The 12 items were scored and categorized into poor health condition (score < 50), The Cronbach’s α of SF-12 was 0.72.

Statistical Analyses

All statistical analyses were performed using the Statistical Package (SPSS) software version 18.0 for Windows. Simple and Multiple logistic regression were applied to determine possible associations between near miss road traffic incidents and the other variables. Significance was set for a \( p < 0.05 \) level.

Results

A total of 379 public van drivers participated and completed questionnaires. 99.5% of the sample was male. The mean age was 44.8 ± 8.9 years old. Most of...
them was married (71%) and graduated from Secondary School (43.8%). The average working experience was 7.5 ± 5.5 years. Regarding working condition, 87.9% had working hours less than or equal to 8 hours per day and 50.0% had break time less than 30 minutes per round. The average working day was 6.5 ± 0.8 days. Regarding health condition, most of public van drivers were current alcohol drinker (39.1%), current smoker (46.7%), and had poor sleep quality (69.6%).

Table 1 shows the prevalence of road traffic near miss incident which accounted for 38.3%. Causes of near misses were classified as “swerve or brake” (82.8%), followed by the “loss of grip” (10.1%), and “skidding” (7.1%).

**Table 1. The prevalence and causes of near-miss road incident (n = 379).**

<table>
<thead>
<tr>
<th>Near-Miss Road Incident</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never occurred</td>
<td>234</td>
<td>61.7</td>
</tr>
<tr>
<td>Ever occurred</td>
<td>145</td>
<td>38.3</td>
</tr>
</tbody>
</table>

**Incident causes**

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skidding</td>
<td>12</td>
<td>7.1</td>
</tr>
<tr>
<td>Loss of grip</td>
<td>17</td>
<td>10.1</td>
</tr>
<tr>
<td>Swerve or brake</td>
<td>140</td>
<td>82.8</td>
</tr>
</tbody>
</table>

Table 2 displays the associated between near miss road traffic incident and selected factors. It was found that an increase in one year of age decreased the likelihood of having near misses by 4%. Having work experience more than 15 years attenuated the likelihood of having near misses (OR = 0.21; 95% CI, 0.09-0.51). Working more than 8 hours per day increased the likelihood of having near misses 2.91-fold (95% CI, 1.54-5.48). Those who have violation driving behavior and had history of speed ticket increased the likelihood of having near miss road incident (OR = 1.07; 95% CI, 1.01-1.15 and OR = 1.83; 95% CI, 1.19-2.82, respectively). With regard to smoking status, current smokers increased the likelihood of having near misses 1.80 fold (95% CI, 1.17-2.79) compared to nonsmokers. Public van drivers who reported having poor sleep quality were found to be 3.29 times more likely to have near miss road traffic incident (95% CI, 1.36-7.99). Multiple logistic regression revealed that more working experience (OR\textsubscript{adj} = 0.30, 95% CI: 0.11-0.77), longer working hour (OR\textsubscript{adj} = 2.83, 95% CI: 1.34-5.95), violation driving behavior (OR\textsubscript{adj} = 1.11, 95% CI: 1.01-1.21), current smoking (OR\textsubscript{adj} = 1.65, 95% CI: 1.02-2.66), and poor sleep quality (OR\textsubscript{adj} =3.36, 95% CI: 1.22-9.23) were the predictors of near miss road traffic incidents.

**Discussions**

The present study aims to assess the prevalence and identify associated factors of near miss road traffic incident among van drivers in Thailand. The prevalence of near-miss road incidents among public van drivers is 38.3%, which was found to be slightly higher than the prevalence of near-miss road incidents among bus drivers in Malaysia (37.5%)\textsuperscript{12}. However, the sample in this study had lower working experience which lower working experience was found to increase risk of road traffic accidents\textsuperscript{12}.

**Table 2. Association between near-miss road traffic incident and selected factors using the logistic regression analyses (n = 379).**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Near misses road traffic accident</th>
<th>Crude OR</th>
<th>95% CI</th>
<th>p-value</th>
<th>Adjusted OR</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td></td>
<td>0.96</td>
<td>0.93-0.98</td>
<td>0.001*</td>
<td>0.98</td>
<td>0.95-1.01</td>
<td>0.268</td>
</tr>
<tr>
<td>Working experience</td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td>1.01</td>
<td>0.63-1.64</td>
<td>0.938</td>
</tr>
<tr>
<td>≤5</td>
<td></td>
<td>0.81</td>
<td>0.52-1.26</td>
<td>0.366</td>
<td>1.01</td>
<td>0.63-1.64</td>
<td>0.938</td>
</tr>
<tr>
<td>6-14</td>
<td></td>
<td>0.21</td>
<td>0.09-0.51</td>
<td>&lt;0.001**</td>
<td>0.30</td>
<td>0.11-0.77</td>
<td>0.013*</td>
</tr>
<tr>
<td>≥15</td>
<td></td>
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</tbody>
</table>
Table 2. Association between near-miss road traffic incident and selected factors using the logistic regression analyses (n = 379).

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<table>
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<tbody>
<tr>
<td><strong>Working hours per day</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>≤ 8</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;8</td>
<td>2.91</td>
<td>1.54-5.48</td>
<td>2.83</td>
<td>1.34-5.95</td>
<td>0.006*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Risky driving behavior</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lapses</td>
<td>0.93</td>
<td>0.82-1.05</td>
<td>0.274</td>
<td>0.87</td>
<td>0.72-1.06</td>
</tr>
<tr>
<td>Violation</td>
<td>1.07</td>
<td>1.01-1.15</td>
<td>0.020*</td>
<td>1.11</td>
<td>1.01-1.21</td>
</tr>
<tr>
<td>Slip</td>
<td>0.96</td>
<td>0.89-1.03</td>
<td>0.322</td>
<td>0.90</td>
<td>0.80-1.02</td>
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<td></td>
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<td></td>
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<tr>
<td><strong>History of speeding tickets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1.00</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.83</td>
<td>1.19-2.82</td>
<td>0.006*</td>
<td>1.59</td>
<td>0.98-2.57</td>
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<tr>
<td><strong>Smoking status</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Not smoking</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used to smoke</td>
<td>0.83</td>
<td>0.34-1.99</td>
<td>0.679</td>
<td>0.92</td>
<td>0.36-2.33</td>
</tr>
<tr>
<td>Smoking</td>
<td>1.80</td>
<td>1.17-2.79</td>
<td>0.008*</td>
<td>1.65</td>
<td>1.02-2.66</td>
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<tr>
<td></td>
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<tr>
<td><strong>Sleep quality</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not good</td>
<td>3.29</td>
<td>1.36-7.99</td>
<td>0.008*</td>
<td>3.36</td>
<td>1.22-9.23</td>
</tr>
</tbody>
</table>

*p-value <0.05, **p-value <0.001

More working experience was found to reduce the risk of near misses. This may be explained by the fact that the more working experience, the better skilled driving and more familiar with the driving route which makes it possible to be aware of the risk of an accident. This finding was consistent with the study by Alavi et al. 13 which found that truck drivers and bus drivers who had more working experience would help reduce the risk of road accident by 5 percent.

Our study found that longer working hours per day is significantly associated with near misses. This finding concurs with Tumwesigye et al. 14 who found that increase in working hours per day is significantly associated with injury from road traffic accidents. We found that 12.1% of the study sample had more than or equal to 8 hours of working hours per day. In addition, data from the Transportation Division in Thailand report that the distance of some routes of inter-provincial van were more than 300 kilometers. Therefore, the explanation is based on the fact that an increase in driving distance combined with traffic congestion in their driving route resulted in having longer working hours per day, which in turn increased the risk of having near miss incidents.

Interestingly, we found positive association between near misses and violations driving behavior as well as history of speeding tickets. Cordazzo et al. 15 found that motorists with aggressive behavior (Violations) and slip-up (Lapses) were related to road traffic accidents. Data from the Department of Land Transport in Thailand regarding the complaint of public passenger vans in the first five months of year 2018 reported that there were 993 complaints of the passenger vans and the top three complaints were reckless driving followed by lousy behavior; both verbal and mannerisms, and overloading passengers. Basically, reckless driving behavior and overloading of passenger seats was considered to be a violations behavior which is a bad driving behavior and it could result in a near-miss incident and road traffic accident.

Cigarette smoking habits was found be associated with near miss road traffic accidents. This was accordant with a study of Saadat and Karbakhsh 16. Almost half of our study sample were current smokers. It may explain...
that smoking cigarette while driving could distract the driver and thus unable to fully control the steering wheel due to the other hand needed to hold the cigarette. In addition, it was found that cigarette smoking was associated with poor sleep quality because the nicotine from cigarette would act as a neurotransmitter that stimulated the smokers so that they found it hard to fall asleep as well as have a shorter amount of time to fall asleep than non-smokers, therefore it had an impact on the quality of sleep which in turn could increase risk of near misses.

Sleep quality in the study sample was poor, accounting for 69.6%. It was found that drivers with poor sleep quality were at risk of near-miss road incidents. The interview with study samples found that they had unstable working hours. Sometimes they had to get up very early in the morning and sometimes they received the last working queue, thus, they had to go home very late at night or ended up spending overnight in their van to start working again next early morning. Sleeping in a van is not comfortable due to the limited sleeping space; therefore, it might be possible for van drivers to have poor sleep quality and be positively associated with a near-miss road incident, consistent with the study by Mahdi et al.

**Conclusion**

Most public van drivers experience near miss road traffic incidents especially by having low work experience (less than 5 years) and longer working hours per day. Moreover, violation driving behaviors and history of speeding tickets are also factors affecting near misses. Interestingly, poor sleeping quality increased the likelihood of near miss road traffic incidents. These findings recommend that the authorized organizations set up hours of operation and allocate timetables for public van drivers to provide enough rest and have better sleep quality. Promoting safe driving behaviors among public van drivers should be intervened in order to prevent the occurrence of near miss incidents which in turn could reduce the impacts from road traffic accidents.

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**Declaration of Conflicting Interests:** The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Ethical Clearance:** This study was approved by the Ethical Committee for Human Research of the Faculty of Public Health, Mahidol University (No. MUPH 2018-006). Informed consent was obtained from all participants.

**Source of Funding:** Self

**References**


The Effect of Special Exercises for those with (Cognitive Concentration) in the Development of Motor Satisfaction and Learning Some Types of Scoring Basketball for Students

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¹The Iraqi University/ College of Dentistry /Iraq, ²Ministry of Higher Education / Department of Student Activities/Baghdad/Iraq, ³The Iraqi University/ Department of Student Activities /Iraq

Abstract

The importance of the research in the preparation of special exercises to develop some types of basketball scoring as a contribution to help the physical education teacher to find successful educational alternatives. The purpose of the study was to prepare special exercises for the cognitive (cognitive) survey in the development of motor satisfaction and learning some types of Scoring for basketball for students. Learn about the effect of cognitive exercises in cognitive development in students. The survey included students from the first stage of the Faculty of Physical Education and Sports Science University of Diyala (159) divided into 6 people. The sample was randomized by (b) and (b) D) and after dispersion by the standard method In the (survey - focus) cognitive as the research sample consisted of (20) students per group. It took the curriculum using special exercises (9) weeks by two units per week in the unit time (90) minutes was invested the application part of each unit, The researchers found the following conclusions: - Special exercises have a high effectiveness in learning some types of Scoring basketball, and special exercises to teach students to develop motor satisfaction, the cognitive group outweighs the cognitive focus of learning the skills of lateral Scoring and peaceful Scoring, The study also recommends that students use special exercises to teach some types of Scoring in the basketball - to detect and differentiate between learners in the cognitive way (scanning the cognitive focus) before starting the learning process of some types Scoring basketball because of its impact in the process of learning - work on the development of motor satisfaction of students because of its importance.

Keywords: Special exercises, cognitive (surveying), motor satisfaction, types of Scoring.

Introduction

The scientific progress witnessed by the world in all fields, including the field of sports education is one of the basic rules in building the human to meet the demands of different life. The educational process, whether theoretical or practical, is the most prominent to reach the facts, as it is based on the preparatory and operational aspects through which the transfer Information from the teacher to the student, and that the choice of the appropriate method will achieve the objectives of the educational process and direct it in the right direction, which keeps pace with the development in the level of performance of all games, including basketball game, which has a distinctive character of performance in terms of mental and physical and For a skill.

Cognitive methods that contribute to the detection of individual differences in cognitive dimensions between individuals are the two forms of cognitive scanning - focusing. These two methods represent the integration that organizes and coordinates knowledge and social behavior and in relation to cognitive processes that fall within complex cognitive processes.¹

The motor satisfaction is an important place in the psychology of sports, because it helps in determining the type of behavior expected in the future and also contributes to directing the individual tendencies and motivations towards the exercise of some sports activities, but it is the outcome of emotional feelings felt by the individual towards a particular activity, The ability to perform various motor skills, the more the athlete is
distinct and successful as evidenced by the high degree of satisfaction with his movements.

The basketball game is one of the most widely practiced sports and is well positioned as an exciting game in the interplay of defensive and offensive skills. The main purpose of the basketball game is to hit the maximum number of points in the opponent’s basket. There are many methods and methods of Scoring from different places and distances. Here is the importance of research in the preparation of special exercises in the method of discovery wave to develop some types of Scoring basketball as a contribution to help the physical education teacher to find successful educational alternatives.

**Research aims:**

Preparation of special exercises for cognitive surveying in the development of motor satisfaction and learning some types of basketball Scoring for students.

Identifying the effect of special exercises for cognitive surveying in the development of students’ motor satisfaction.

Identifying the effect of special exercises for those with (cognitive concentration) of learning some types of Scoring basketball for students.

**Research Methodology:**

The experimental approach of the two equal groups was used to suit the nature of the problem.

**The research community and its sample:**

The research community of the first stage students of the Faculty of Physical Education and Sports Sciences \ University of Diyala (159) divided into 6 people were randomly selected Division B and D and after dispersion by the standard cognitive method (survey - Concentration (cognitive) as the research sample consisted of:

The first experimental group consisted of (B) students of the first stage (20) students from (survey) and the total (29) students.

The second experimental group consisted of students of the first stage (D) in the Faculty of Physical Education / Diyala University and the number of (20) students of the (concentration) and the total (30) students.

**Homogeneity of the sample:**

The researchers conducted a process of homogeneity among the sample members according to the variables (length, weight, age) to adjust the research variables and homogeneity of the sample as shown in Table (2).

**Table (1). The sample is divided according to representative systems**

<table>
<thead>
<tr>
<th>S</th>
<th>Groups</th>
<th>Number of students</th>
<th>Cognitive style</th>
<th>Total number of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>29</td>
<td>Survey</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>30</td>
<td>Concentration</td>
<td>20</td>
</tr>
</tbody>
</table>

**Table (2). Homogeneity of the research sample members**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>Median</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>Cm</td>
<td>164.9</td>
<td>12.85</td>
<td>40</td>
<td>165</td>
<td>0.504</td>
</tr>
<tr>
<td>Weight</td>
<td>Kg</td>
<td>69.5</td>
<td>7.64</td>
<td>40</td>
<td>70</td>
<td>0.074</td>
</tr>
<tr>
<td>Age</td>
<td>Year</td>
<td>19.25</td>
<td>0.73</td>
<td>20</td>
<td>20</td>
<td>0.108</td>
</tr>
</tbody>
</table>

The table shows that the torsion coefficient is between (± 3) and this indicates that the data is free from irregular distribution defects.

**Data collection methods:**

The researchers used the following means for the collection of information and data: Arab and foreign sources, interviews with experts, skill tests, and cognitive scale. Devices: Electronic calculator, Medical balance, Stopwatch. Tools: Basketball court, Basketball basket number (15) Legal, Metric measuring tape, whistle,

**Selection of tests used in research:**

The measure of motor satisfaction: a measure originally designed by Nelson and Allen, believing that some measures of body image or measures of self-concept do not give clear attention to the human dynamic aspect.
The scale tries to identify the degree of satisfaction of the individual about his movements and physical characteristics, and Mohammed Hassan Allawi quoted this measure, and the original scale includes (50) words and in the light of the studies conducted on the original phrases were deleted some words and replace other words to suit the procedure in the environment The Egyptian. For example, words such as “I have the ability to keep up with music while dancing” have been deleted. “I can kick a long ball for a long distance” because the phrase is not suitable for students.  

The individual responds to the terms of the scale on the five-step scale (applicable: very, very, very, moderately, very little). The measure is valid for students and secondary school students and university students at the age of 14-22 years.

Scoring:

The scores assigned by the examinee are collected for all gauge terms, and the closer they are to the 150 degree maximum score, the greater the motor satisfaction of the individual.

Testing of the Scoring behind the free throw line (10 throws):  
Purpose of the test: Measure the accuracy of the Scoring for the free throw.
Calculation of grades
Calculate and score one score at each successful shot (the ball enters the basket).
The player does not score any score when the ball does not enter (failed).
The player’s score total points obtained in (10) throws.

Side Scoring test :
Purpose of the test: Measure the skill of the Scoring by performing Scoring towards the basket from a specific place on one side of the target near the corner of the stadium.
The laboratory (10) performs ten Scoring from each side, i.e., the total number of Scoring on the sides (20) twenty Scoring.
Registration: Calculate two grades for each successful score (attempt) to enter the ball in the basket.
Calculate one degree for each Scoring (attempt) to touch the ball ring and do not enter the basket
Do not count the degrees of Scoring in which the ball touches the painting does not enter this basket and record the laboratory the total number of degrees in the twenty attempts in which (ten on each side) that is the maximum score is (40) degrees.

Pacification test.

Purpose of the test: Measure the accuracy of peaceful Scoring.
Tools: basketball court, basketball goal, whistle giving start signal.
Number of attempts: Each student is granted 10 attempts.
Calculation of scores: The player is counted one point for each successful Scoring and the highest point the player can collect.

Pilot study:

The researchers carried out the exploratory experiment (14/10/2018) in order to determine the suitability of the exercises with the sample of the research. The experiment was conducted with the presence of the whole sample (6)
Identify the difficulties and problems that researchers may face when performing tests.
Recognize the time taken for testing and measurement.
Ensure the efficiency of the team and the accuracy of the implementation of tests and measurement.
Test the validity of the tools and devices used and the form of collecting information.
Know the difficulties and problems faced by researchers when implementing the experiment
Fit the exercises with the time of the selected modules.
Pre Tests:
The researchers carried out the Pretests of the
research sample on Wednesday (17/10/2018) in the closed hall (Martyr Mustafa Al-Diri Hall) in the Faculty of Physical Education and Sports Sciences / Diyala University.

Equivalence of the two groups in the search variables:

The researchers performed the equivalence of the two groups in the search variables.

Table (3). Shows the equivalence of the two groups (survey - focus) cognitive variables in the search

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Survey Mean</th>
<th>Survey SD</th>
<th>Concentration Mean</th>
<th>Concentration SD</th>
<th>(t) value</th>
<th>Error Ratio</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor satisfaction</td>
<td>Degree</td>
<td>56.5</td>
<td>10.78</td>
<td>58.9</td>
<td>15.08</td>
<td>0.57</td>
<td>0.56</td>
<td>Non sig.</td>
</tr>
<tr>
<td>Free throw</td>
<td>Degree</td>
<td>4.05</td>
<td>1.87</td>
<td>4.7</td>
<td>2.05</td>
<td>1.04</td>
<td>0.30</td>
<td>Non sig.</td>
</tr>
<tr>
<td>Peaceful Scoring</td>
<td>Degree</td>
<td>5.25</td>
<td>1.29</td>
<td>5.1</td>
<td>1.16</td>
<td>0.38</td>
<td>0.70</td>
<td>Non sig.</td>
</tr>
<tr>
<td>Lateral Scoring</td>
<td>Degree</td>
<td>10.9</td>
<td>2.06</td>
<td>10</td>
<td>3.17</td>
<td>1.12</td>
<td>0.26</td>
<td>Non sig.</td>
</tr>
</tbody>
</table>

Apply special exercises:

The curriculum used special exercises (9) weeks divided into (3) weeks to teach the skill of free throw and (3) weeks to teach the skill of peaceful Scoring and (3) weeks to teach the skill of lateral Scoring by two units per week, (18) Unit Time (90 min) the researchers invested the applied part of each unit.

After the completion of the educational curriculum on Sunday, 23/12/2018, in the hall Martyr Mustafa Al-Diri of the College of Physical Education and Sports Science / University of Diyala. The researchers took care to provide the same organization and the conditions for the implementation of tests and under The same conditions and capabilities used in Pre testing for the purpose of obtaining reliable results.

Results and Discussions

Table (4). Shows the mean and standard deviations of the search variables, pre-test and post-test and sample size for cognitive method Cognitive survey

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Pretest Mean</th>
<th>Pretest SD</th>
<th>Posttest Mean</th>
<th>Posttest SD</th>
<th>(t) value</th>
<th>Error ratio</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor satisfaction</td>
<td>Degree</td>
<td>56.5</td>
<td>10.7</td>
<td>64.9</td>
<td>8</td>
<td>4.56</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Free throw</td>
<td>Degree</td>
<td>4.05</td>
<td>1.87</td>
<td>6.70</td>
<td>0.73</td>
<td>7.12</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Peaceful Scoring</td>
<td>Degree</td>
<td>5.25</td>
<td>1.29</td>
<td>6.30</td>
<td>1.34</td>
<td>2.86</td>
<td>0.01</td>
<td>Sig.</td>
</tr>
<tr>
<td>Lateral Scoring</td>
<td>Degree</td>
<td>10.95</td>
<td>2.06</td>
<td>12.9</td>
<td>1.20</td>
<td>3.42</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Show of the table (3) The value (t) calculated for the satisfaction of the motor, free throw, peaceful break is illegal, the Scoring side has reached (4.56, 7.12, 2.86, 3.42), respectively, while error tests all the percentage of (0.00, 0.00, 0.01, 0.00) is the smallest when compared (0.05) and this indicates the significance of all tests and for the benefit of the post-test.
Table (5). Shows mean and standard deviations of research variables pre and post tests and the value of (t) calculated error rate and the level of significance for people with cognitive focus

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Pretest</th>
<th></th>
<th>Posttest</th>
<th></th>
<th>(t) value</th>
<th>Error ratio</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor satisfaction</td>
<td>Degree</td>
<td>58.9</td>
<td>15</td>
<td>68.1</td>
<td>8.25</td>
<td>3.08</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Free throw</td>
<td>Degree</td>
<td>4.7</td>
<td>2.05</td>
<td>5.8</td>
<td>0.81</td>
<td>2.83</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Peaceful Scoring</td>
<td>Degree</td>
<td>5.1</td>
<td>1.16</td>
<td>7.1</td>
<td>0.93</td>
<td>6.57</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Lateral Scoring</td>
<td>Degree</td>
<td>10</td>
<td>3.17</td>
<td>15.8</td>
<td>1.15</td>
<td>9.94</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Table (4) shows that the calculated (t) value of motor satisfaction, free throw, pacification, lateral Scoring was (3.08, 2.83, 6.57, and 9.94) respectively, while the error rate for all tests was (0.00), This indicates the significance of the test and the benefit of the post-test.

Table (6). Shows the mean, standard deviation, calculated (t) value, error rate, and significance level for cognitive survey (concentration)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>Survey</th>
<th></th>
<th>Concentration</th>
<th></th>
<th>(t) value</th>
<th>Error ratio</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor satisfaction</td>
<td>Degree</td>
<td>64.9</td>
<td>8</td>
<td>68.1</td>
<td>8.25</td>
<td>1.24</td>
<td>0.22</td>
<td>Non sig.</td>
</tr>
<tr>
<td>Free throw</td>
<td>Degree</td>
<td>6.70</td>
<td>0.073</td>
<td>5.85</td>
<td>0.81</td>
<td>3.47</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
<tr>
<td>Peaceful Scoring</td>
<td>Degree</td>
<td>6.30</td>
<td>1.34</td>
<td>7.15</td>
<td>0.93</td>
<td>2.32</td>
<td>0.02</td>
<td>Sig.</td>
</tr>
<tr>
<td>Lateral Scoring</td>
<td>Degree</td>
<td>12.9</td>
<td>1.20</td>
<td>15.8</td>
<td>1.15</td>
<td>7.76</td>
<td>0.00</td>
<td>Sig.</td>
</tr>
</tbody>
</table>

Table (5) shows the indicates that it was insignificant for motor satisfaction between the two scanning groups - the concentration was greater than 0.05 while the significance was significant between the variables.

**Discussion of Results**

It is clear from Table (3, 4) that there are significant differences in favor of the two dimensional tests of the two groups and for all the tests. The researchers believe that it is natural that there is progress in learning the skills of basketball Scoring. This is confirmed by Zafer 2002. As long as the teacher follows the steps of sound foundations for learning and education “(1), and in view of what overwhelmed exercises for the frequency and include performance easy to difficult and an increase in the effects and the thrill of competition. This raises the motives of the learner to achieve the desired goal without feeling bored and boredom at the time and effort within the duration of education as I helped Special increase in the ability to adapt and meet the requirements of the game and participated in the Marin speed up the learning process.
Researchers attributed the reasons for the significant differences between the two tests (posttest) for two groups to test motor satisfaction to the attention of students and encourage them to what to encourage and stir up the fun and happiness atmosphere have the effect of adult in the performance of the skill of shooting with a sense of freedom, safety and practice without feeling fear or to a negative trend towards their kinetic general sense means the satisfaction of the individual from his movements and physical and skill which is “the outcome of emotional feelings felt by the individual towards a particular activity and reflects the extent appropriate satiated to its needs and achieve its objectives), as shown in the table (5) there are significant differences between free throws and cognitive survey group and in the (peaceful break is illegal, the Scoring side) for the benefit cognitive focus group as researchers see the differences dating back to the nature of the style of knowledge for students and commensurate with the skill type (indoor and outdoor), that my style (survey - Focus) Cognitive is associated with attention as a process mentality as it is central and central to it, considering that this method is based mainly on how the student can select certain stimuli without other stimuli and then link them and treat them with an awareness of the sense of the moment and that the factor of attention and maintenance requires a controlled cognitive control, when faced with different educational situations it deals with it in a way that guarantees its compatibility case with these situations and the status of the compatibility of these require him to regulate the function of selective process students’ attention and in accordance with the knowledge of his style, which narrows his attention or expands its range in order to accommodate a larger number of stimuli in a given unit of time so Keep some details of the stimuli in his memory and enable him to respond appropriately.6

Conclusions

Special exercises have a high effectiveness in learning some types of basketball Scoring

Special exercises for her to develop students’ motor satisfaction.

The cognitive style group is superior to the cognitive focus by learning the skills of lateral Scoring and peaceful Scoring.

The cognitive style group is superior to the cognitive survey by learning the skill of free throw.

Evolution of the motor satisfaction of the two groups (survey - focus) cognitive.

Ethical Clearance- Taken from The Iraqi University

Source of Funding- Self

Conflict of Interest - None

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6. Bansode NN. Effects of selected yogic exercises of fitness components and basic basketball skills of school children from 12 to 14 years. 2012;
Evaluation of Work Posture with Quick Exposure Check (QEC) at Workstations for Toluene sulfonyle Hydrazide and Azodicarbonamide Reactions in the Chemical Processing Industry

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Abstract

Poor work posture is a major cause of work-related skeletal muscle disorders and is often found in the chemical industry. The highest risk for skeletal muscle disorders due to work is in the upper arm and wrist. This study aims to evaluate ergonomics as a reference for assessing factors that affect skeletal muscle disorders due to work, one of which is work posture. The study uses qualitative analysis with descriptive observations of work posture in workers using Quick Exposure Check. The study was conducted at two work stations: the toluene sulfonyle hydrazide and azodicarbonamide reactions in the chemical processing industry. The two stations were chosen because they involved transport activities and presented similarities in the characteristics of the work. The results of the exposure score calculations show that the value for the shoulder/arm and back were at a very high level, with a very high risk of injury. Exposure levels at both work stations were in the range of 81–94%. This shows that further research is needed to investigate and determine immediate changes.

Keywords: Evaluation, Work Posture, QEC, Chemical Processing Industry

Introduction

Work-related skeletal muscle disorders are occupational diseases often found in workers in a range of occupations, where cases can reach 45% of total occupational diseases \textsuperscript{1}. In Indonesia, statistical data related to work-related skeletal muscle disorders is still insufficient; however, several studies have indicated that risks for work-related skeletal muscle disorders are found in several industrial sectors in Indonesia because of poor work attitudes. For example, 53% of workers in the iron industry in Bantaran were found to be experiencing work-related skeletal muscle disorders due to work attitudes \textsuperscript{2}, and 92.31% of workers in the manufacture of steam boilers were also found to be experiencing complaints at the waist due to unnatural work attitudes \textsuperscript{3}.

Workers at chemical industry workstations can be found in awkward postures, with the highest risk for skeletal muscle disorders due to work being in the upper arm and wrist. Nearly 50% of workers’ body positions are not ergonomic, and almost 75% of their work is done manually. In addition, they generally do not pay enough attention to work posture due to limited space, which forces workers to work in awkward body postures \textsuperscript{4}. Work involving lifting improperly at workstations may also cause lower back pain \textsuperscript{5}.

Grandjean stated that, in the concept of ergonomics, the main priority is to adjust the design and work systems of the machine to the ability and limitations of humans \textsuperscript{6}. Research in applying ergonomic principles can correct work attitudes such that work-related skeletal muscle disorders may be decreased by as much as 40.28 \% \textsuperscript{7}. Work attitude interventions can also reduce work-related skeletal muscle disorders \textsuperscript{8}, while the results of another study, conducted in Bantul, showed that work systems with a total ergonomics approach can reduce workers’
skeletal muscle disorders by 87.8\%.

This study aims to evaluate ergonomics as a reference for assessing factors that affect skeletal muscle disorders due to work, one of which is work posture. This is an overview of basic information in the development of a program to reduce the incidence of Occupational Disease. Especially work-related skeletal muscle disorders—and can be extended with further research as a basis for ergonomic improvement models in the chemical processing industry.

**Method**

This study has completed ethical clearance procedures and received an ethics permit for implementation from the research ethics commission on Public Health Services at the Faculty of Public Health, University of Indonesia (no. 274.UN2.F10/PPM.00.02/2018). The study, in the chemical processing industry, uses qualitative analysis with descriptive observations of work posture in workers using QEC. The study was conducted at two work stations: the toluenesulfonil hydrazide (TSH) and azodicarbonamide (ADCA) reactions of chemical process industry at Cilegon City, Banten Province. The two stations were chosen because they involved transport activities and presented similarities in the characteristics of the work.

**Results and Discussion**

*Exposure scores and action levels of workers at the TSH and ADCA reactions workstations were obtained through observation using the QEC method (Tables 1 and 2). Two activities were assessed; at the TSH workstation, these were beating and lifting of the raw material paratoluene sulfonylchloride; at the ADCA workstation, these were weighing and packing the chemical Azodicarbonamide.*

**Table 1. Exposure Scores**

<table>
<thead>
<tr>
<th>Work station</th>
<th>Task</th>
<th>Back</th>
<th>Shoulder/arm</th>
<th>Wrist</th>
<th>Neck</th>
<th>Exposure score</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSH</td>
<td>Beating paratoluene sulfonylchloride</td>
<td>42</td>
<td>56</td>
<td>38</td>
<td>16</td>
<td>152</td>
</tr>
<tr>
<td>TSH</td>
<td>Lifting paratoluene sulfonylchloride</td>
<td>42</td>
<td>44</td>
<td>34</td>
<td>16</td>
<td>136</td>
</tr>
<tr>
<td>ADCA</td>
<td>Weighing azodicarbonamide</td>
<td>56</td>
<td>48</td>
<td>46</td>
<td>16</td>
<td>166</td>
</tr>
<tr>
<td>ADCA</td>
<td>Packing azodicarbonamide</td>
<td>56</td>
<td>48</td>
<td>46</td>
<td>16</td>
<td>166</td>
</tr>
</tbody>
</table>

**Table 2. Action Levels**

<table>
<thead>
<tr>
<th>Work station</th>
<th>Task</th>
<th>Exposure level</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSH</td>
<td>Beating paratoluene sulfonylchloride</td>
<td>93.82 %</td>
<td>Investigate and change immediately</td>
</tr>
<tr>
<td>TSH</td>
<td>Lifting paratoluene sulfonylchloride</td>
<td>81.48 %</td>
<td>Investigate and change immediately</td>
</tr>
<tr>
<td>ADCA</td>
<td>Weighing azodicarbonamide</td>
<td>94.31 %</td>
<td>Investigate and change immediately</td>
</tr>
<tr>
<td>ADCA</td>
<td>Packing azodicarbonamide</td>
<td>94.31 %</td>
<td>Investigate and change immediately</td>
</tr>
</tbody>
</table>
The exposure levels, shown in Table 2, were in the range of 81–94%. This shows that further research is needed to investigate and implement immediate change. From the results of the exposure score calculation, it can be seen that the value for the shoulder/arm and back are at the very high level, which means that the risk of injury is also very high.

Work activities at TSH workstations are beating and lifting paratoluene sulfonylchloride into a test tube. The highest score contributing to the risk of injury is the shoulder/arm position. The position of the arm forms an excessive angle as the arm is lifted away from the body. The worker must soften the material manually by beating it as hard as possible with his arm. The arm becomes the dominant body part used when beating the paratoluene sulfonylchloride.

The second activity is lifting the paratoluene sulfonylchloride. The highest score contributing to the risk of injury is the back. When lifting one drum of paratoluene sulfonylchloride, the material’s position is below the level of the worker’s foot, and it is lifted with an unnatural and forced (bent) position. The TSH reaction workstation has a lifting team of three people, lifting a load of 100 kg, with the workers’ bodies starting in an odd, bent position.

Work activities at the ADCA work station are weighing and packing of azodicarbonamide. The highest score contributing to the risk of injury is the back. When weighing azodicarbonamide, the body starts in a bent position and is then twisted. The position of the box is at the bottom, and the mouthpiece of the mixer is too close to the box, forcing the worker to bend his body. When packing, the position of the box containing the azodicarbonamide is below the level of the worker. This forces workers to bend their bodies to be able to pack the azodicarbonamide.

Conclusions

The results of the study show that the riskiest work postures were in weighing and packing at the ADCA workstation. The exposure level was in the 94% range, showing that further research is needed to investigate and implement immediate change. At ADCA work stations, the highest contribution to the risk of injury in the weighing and packing of the azodicarbonamide is the back. Workers at the ADCA workstation should be given a variable work rotation that alternates between bending, sitting, kneeling, squatting, and placing the object precisely within the range of the arm, so that the flexion angle is not formed. At the TSH workstation, the highest contribution to the risk of injury is the shoulder/arm. Softening of paratoluene sulfonylchloride by beating should be assisted by a tool, so that it does not use manual power.

Ergonomic training is absolutely essential so that workers are knowledgeable and skillful with postural control mechanisms. Ergonomic operational standards for each work action must be provided at all work stations to make it easier for workers to apply ergonomic principles in each work activity. Some ergonomic principles that can be recommended include administrative and engineering controls. Further research should be conducted on ergonomic improvement models related to workplace design, within the scope of the workplace dimensions and in accordance with the characteristics of the work in the chemical processing industry.

Acknowledgment: This research was partially supported by Hibah PITTA 2018 funded by DRPM Universitas Indonesia No. 5000/UN2.R3.1/HKP.05.00/2018. The authors would like to thank colleagues from the chemical processing industry in Cilegon City and the Manpower Office in Banten Province, for their dedication in helping us complete this research. We would also like to thank the Ministry of Manpower of The Republic Indonesia and Department of Occupational Health and Safety, Faculty of Public Health, Universitas Indonesia

Competing Interests: The authors declare that they have no competing interests

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1. Eurostat. Work health EU. Luxembourg: European Communities; 2004


Psychosocial Overview of Work-related Musculoskeletal Disorders: A Preliminary Study in the Chemical Process Industry

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Abstract

Health problems cause the greatest amount of disability in Indonesia (GBD, 2016). The top two causes are lower back and neck pain. The factors that cause Musculoskeletal Disorders (MSDs) include physical, individual, psychosocial, occupational, and environmental factors. The aim of this study was to perform a preliminary overview to look at the relationship between psychosocial factors and MSDs in the chemical process industry. A questionnaire instrument was completed by 43 male workers in the chemical process industry in Cilegon, Indonesia. A psychosocial risk factor analysis was used to evaluate the consequences of MSDs felt by workers in the last 12 months at work. Lisrel software output, in the form of validity and reliability test results, was based on the value of Standardized Loading Factor (SLF), t-value and Construct Reliability (CR) value, Variance Extracted (VE) value, and useful index. R² coefficient values were based on observed variables, including counter variables on the welfare of subordinates (64%), appreciation for suggestions (64%), work completion (54%), success in building teamwork (70%), and ability to obtain work satisfaction (51%). MSDs factors are related to body parts, such as shoulder (82%), upper back (92%), knee (72%), and ankle (51%).

Keywords: MSDs, Psychosocial, LISREL, Chemical Process Industry.

Introduction

Many health problems cause disability in Indonesia (GBD, 2016), with the first two being lower back and neck pain. These amounted to 24.8% in 2005-2016. The occurrence of occupational diseases in Indonesia from year to year continues to increase. Based on the Ministry of Manpower’s reports in 2015 and 2016, there was an increase of 5,659 cases. 32% of all cases in America were cases of MSDs (1). The prevalence of cases of MSDs in the UK in 2015/2016 was 539,000, which constituted 41% of the total of occupational diseases in all industries (2). According to data on Eurostat figures on recognized occupational diseases in Europe in 2005, MSDs came first at 38.1%. Also, a survey was carried out and found 24.7% of workers experiencing pain, 22.8% with muscle pain, and 45.5% working in severe conditions. The development of the chemical industry is increasing. Based on BPS data (2015), the number of companies in the chemical industry in 2013, 2014, and 2015 were as many as 978, 1,002, and 1,075, respectively. CATIA software simulations show awkward work postures in suspending agent workstations can reduce score RULA the potential risk MSDs (3). Physical and psychosocial factors would be more significantly associated with MSDs symptoms. (4–8) The factors of socialization in the field of chemical processing have not been studied further and their effects on the suspension of the skeletal muscle system are unknown. The aim of this study was to determine the factors that influence the psychosocial experience at work.

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Method

The survey was conducted on 43 male workers in the chemical process industry. The inclusion criterion was at least one year working experience in the current position. Data analysis was based on psychosocial factors, including 38 questions referring to psychosocial exposure at work, four questions about work in general, and one question about workers’ perception of work stress in general. MSDs focused on complaints over the past 12 months as having disorders (pain and/or discomfort) in the regions of the neck, shoulders, upper back, knees, and ankles. Analysis was carried out on data that had been processed with LISREL software version 8.7 through the SIMPLIS syntax program.

Results

The results of demographic analysis showed a median age of 37 years old (SD 10 years); length of time working in the company of 15 years (SD 9 years); education level of (79%) junior high/high school and (21%) diploma/college; and marital status as (77%) married and (23%) single.

There were five psychosocial variables that fulfilled the requirements to be analyzed further. These included indicators of variable support from the leader about subordinate welfare attention, support from the leader about appreciation for suggestions from subordinates, the role of leaders to help complete the work, the role of leadership in building teamwork, and individual job satisfaction in utilizing self-ability.

Table 1. Overall Value Match Test Result

<table>
<thead>
<tr>
<th>GOF Size</th>
<th>Match Level Target</th>
<th>Estimation Result</th>
<th>Match Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square</td>
<td>Small Value</td>
<td>29.40 (p=0.29)</td>
<td>Good Fit</td>
</tr>
<tr>
<td>P</td>
<td>P &gt; 0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCP</td>
<td>Small Value</td>
<td>0.96</td>
<td>Good Fit</td>
</tr>
<tr>
<td>Interval</td>
<td>Small Interval</td>
<td>(0.00 ; 17.57)</td>
<td></td>
</tr>
<tr>
<td>RMSEA</td>
<td>RMSEA &lt;=0.08</td>
<td>0.030</td>
<td>Good Fit</td>
</tr>
<tr>
<td>p(close fit)</td>
<td>p &gt;= 0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECVI</td>
<td>Small value and close to ECVI saturated</td>
<td>M* = 1.55 S* = 2.14 I* = 7.70</td>
<td>Good Fit</td>
</tr>
<tr>
<td>AIC</td>
<td>Small value and close to AIC saturated</td>
<td>M* = 64.96 S* = 90 I* = 323.38</td>
<td>Good Fit</td>
</tr>
<tr>
<td>CAIC</td>
<td>Small value and close to CAIC saturated</td>
<td>M* = 64.96 S* = 214.25 I* = 348.38</td>
<td>Good Fit</td>
</tr>
<tr>
<td>NFI</td>
<td>NFI &gt;= 0.90</td>
<td>0.90</td>
<td>Good Fit</td>
</tr>
<tr>
<td>NNFI</td>
<td>NNFI &gt;= 0.90</td>
<td>0.98</td>
<td>Not Good</td>
</tr>
<tr>
<td>CFI</td>
<td>CFI &gt;= 0.90</td>
<td>0.99</td>
<td>Not Good</td>
</tr>
<tr>
<td>IFI</td>
<td>IFI &gt;= 0.90</td>
<td>0.98</td>
<td>Good Fit</td>
</tr>
<tr>
<td>RFI</td>
<td>RFI &gt;= 0.90</td>
<td>0.87</td>
<td>Not Good</td>
</tr>
<tr>
<td>CN</td>
<td>CN &gt;= 200</td>
<td>66.20</td>
<td>Not Good</td>
</tr>
<tr>
<td>RMR</td>
<td>Standardize RMR &lt;=0.05</td>
<td>0.057</td>
<td>Good Fit</td>
</tr>
<tr>
<td>GFI</td>
<td>GFI &gt;= 0.90</td>
<td>0.88</td>
<td>Good Fit</td>
</tr>
<tr>
<td>AGFI</td>
<td>AGFI &gt;= 0.90</td>
<td>0.78</td>
<td>Good Fit</td>
</tr>
</tbody>
</table>

*M = Model; S = Saturated; I = Independence
Evaluating the validity of a variable, it is to have good validity for the construct or its latent variables if the t-value of the factor loading is greater than the critical value \((\geq 1.96\) or \(\geq 2\)), and the standard factor load (standardized factor loading) \(\geq 0.70^{(9)}\) or \(\geq 0.50^{(10)}\).

### Table 2. Overall Value Match Test Result

<table>
<thead>
<tr>
<th>Var. Laten</th>
<th>X1</th>
<th>Y</th>
<th>Conclusion Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLF*</td>
<td>Nilai-t</td>
<td>SLF*</td>
<td>Nilai-t</td>
</tr>
<tr>
<td>X57</td>
<td>0.80</td>
<td>6.03</td>
<td>-</td>
</tr>
<tr>
<td>X58</td>
<td>0.80</td>
<td>6.01</td>
<td>-</td>
</tr>
<tr>
<td>X59</td>
<td>0.74</td>
<td>5.35</td>
<td>-</td>
</tr>
<tr>
<td>X60</td>
<td>0.84</td>
<td>6.42</td>
<td>-</td>
</tr>
<tr>
<td>X67</td>
<td>0.71</td>
<td>5.11</td>
<td>-</td>
</tr>
<tr>
<td>Y12BAHU</td>
<td>-</td>
<td>-</td>
<td>0.90</td>
</tr>
<tr>
<td>Y12PATAS</td>
<td>-</td>
<td>-</td>
<td>0.96</td>
</tr>
<tr>
<td>Y12LUTUT</td>
<td>-</td>
<td>-</td>
<td>0.85</td>
</tr>
<tr>
<td>Y12PKAKI</td>
<td>-</td>
<td>-</td>
<td>0.72</td>
</tr>
</tbody>
</table>

* SLF = Standardized Loading Factor. SLF target\(\geq 0.70\) or 0.50

** = Set by default by LISREL, the t-value is not estimated. Target \(t\geq 2\)

The validity of all observed variables for the latent variable is useful. The evaluation of reliability is made from the measurement using composite reliability measure and VE measure. The results of the reliability test calculation, CR variable Y (0.92), X1 (0.88) \(\geq 0.70\), and VE value 0.74 \(\geq 0.50\) mean that the construct measurement reliability is good, except for VE value for variable X1 (0.18) \(\leq 0.50\), which is not good.

### Discussion

Issues in PLS-SEM is that of minimum sample size estimation, where the ‘10-times rule’ method has been a favorite because of its simplicity of application it builds on the rule that the sample size should be greater than 10 times the maximum number of inner or outer model links pointing at any latent variable in the model \((11)\). Two related methods, based on mathematical equations, as alternatives for minimum sample size estimation in PLS-SEM: the inverse square root method and the gamma-exponential method, Based on three Monte Carlo experiments, demonstrated that both methods are fairly accurate \((12)\). The structural equation values observed are \(Y = 0.13 \times X1\), and the \(R^2\) values = 0.018. Structural equations are equations of structural models. This regression equation shows the results of estimating unstandardized coefficients between latent variables. We also showed that the first method is particularly attractive in terms of its simplicity of application. According to \((13)\), the determination coefficient \(R^2\) of the structural equation does not have a clear interpretation and to interpret \(R^2\), the reduced form \(Y\) must be taken. Based on the modification index, it is necessary to add paths between latent variables and observed variables. The addition of a path causes the causal relationship in the model to impact the addition of a hypothesis. Further research is needed to add paths between latent variables and observed variables, namely individual factors, occupational factors, or the environment. The prevalence of MSDs, particularly in the knees, neck, low back, and shoulder were found to be high \((14)\). Ergonomics and application to MSDs associated with the modern workplace provide both an important perspective and
a preventative approach, and psychosocial factors (monitoring, help from management, and workload, low job strain job dissatisfaction) would be more significantly associated with MSD symptoms (4,5,15).

The description of psychosocial factors, based on the estimated parameter value of the R² coefficient on the latent variable (X1) observed, is the leadership support variable for the welfare of subordinates (64%), appreciation for suggestions/proposals (64%), completion of work (54%), success in building work as a team (70%), and satisfaction in the ability to work (51%). The MSDs (Y) factor is related to specific body parts, namely shoulder (82%), upper back (92%), knee (72%), and ankle (51%).

For the evaluation of validity, SLF value for all variables are observed >=0.70 and t-value >2. The validity of all observed variables on their latent variables is useful. The results of the reliability test calculation, the value of CR >= 0.70, and VE >= 0.50 were acceptable, so the reliability of the construct measurement is good, except the VE value for the variable X1 <= 0.50 is not good.

**Conclusion**

In conclusion we observed psychosocial factors (Leadership support variable for the welfare of subordinates, appreciation for suggestions, completion of work, success in building work as a team, and satisfaction in the ability to work) and would be more significantly associated with MSDs symptoms shoulder, upper back, knee, and ankle.

Approaches to future research and interventions in the chemical process industry should include better, more integrated measures of psychosocial, individual and occupational factors, or environment.

**Limitations**

This research has limitations:

This study is a preliminary study using a limited sample size, so in order to see an overview of the comparisons between GOF and the level of compatibility, a sample size with a minimum of 100 samples must be considered.

Other factors, in addition to psychosocial factors, must be included in the design of the construct. It is essential to know the complexity of a model in solving a problem, so it might contribute through a relatively high prevalence of other factors that are preserved.

In order to overcome this limitation, longitudinal studies with a larger sample size are needed to allow a more definitive conclusion about the cause of the inter-factor relationship of MSDs.

**Acknowledgement:** This study was supported by grants PITTA from Universitas Indonesia. Authors declare that there is no conflict of interest for the result of the study.

**Ethical Clearance:** This study has been approved by the Health Research Ethics Committee of the Universitas Indonesia, Faculty of Public Health with register number 808/H2.F10/PPM.00.02/2018.

**References**


Effect of District-focused Approach on Health Information System Performance in Indonesia

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Abstract

Background: The Health Information System (HIS) condition in Indonesia is not at an optimum level yet, and there is still much to be done to improve and strengthen all HIS components. The objectives of this study were to evaluate whether the district-focused approach could improve the performance of district-level HIS networks in Indonesia. Method: The study was carried out to evaluate the project, which was implemented in ten districts in five provinces of Indonesia. This evaluation study used two approaches: a) the Health Metric Network (HMN) framework from the World Health Organization (WHO), and b) the System Success Model from DeLone and McLean. Results: Initial assessment results in early 2017 were compared to those at the end of the project in May 2018, and HIS performance increased for each component in all districts. However, the achievements were not fully optimized, and there is room for further strengthening. Most participants of the System Success Model assessment reported that HIS strengthening was successful and useful, with 89% improvement in system quality, 85% in information quality, 93% in service quality, 96% in individual impact, and 89% in organizational impact. Keywords: Evaluation, Health Information System, Health System Strengthening, District Health System

Introduction

In Indonesia, decentralization has proceeded rapidly, but decentralization of the health sector has been a double-edged sword. Districts and cities have an important position to meet the local health needs, as these were often not previously handled by the central government, leading to negligence of infectious disease management in remote areas. However, there are several challenges with this decentralization, especially in terms of policy, program, and standards implementation that should be consistent across districts and cities. The Health Information System (HIS), in particular, is lacking after applying decentralization policies.

Many districts and cities have limited capacity to determine what programs must be prioritized. District and city budgets tend to focus more on salaries and infrastructure development rather than human resources and the development of indispensable health system components.

Disease management projects have long identified that a strong HIS is a key component of improving disease control program performance. Quality, adequate, accurate, and timely health information has a strategic position in effective performance improvement. However, an ideal HIS has not yet been effectively implemented in Indonesia. Today, policy makers in the health sector often experience difficulties in making appropriate decisions because of limitations in accurate, precise and timely data and information.

The Indonesian Ministry of Health’s Center for Data and Information has assessed the HIS condition in Indonesia several times since 2007. The assessment uses a framework developed by the World Health Organization (WHO), known as the Health Metrics Network (HMN). The results indicate that, even though...
there have been improvements in all the evaluated components (see Table 1), none of the components of the HIS in Indonesia are at an optimum level, and there is still much to be done to reinforce and improve the HIS. A component gets a 100% value when each element of the component works. Of the existing components, data management consistently earns the lowest rating throughout the assessment. This HIS component must be prioritized to strengthen the entire system.

**Table 1. Indonesian HIS Assessments in 2007, 2012 and 2016**

<table>
<thead>
<tr>
<th>HIS Components</th>
<th>2007</th>
<th>2012</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources</td>
<td>47%</td>
<td>54.1%</td>
<td>58%</td>
</tr>
<tr>
<td>Indicators</td>
<td>61%</td>
<td>67.2%</td>
<td>76%</td>
</tr>
<tr>
<td>Data Sources</td>
<td>51%</td>
<td>59.9%</td>
<td>69%</td>
</tr>
<tr>
<td>Data Management</td>
<td>35%</td>
<td>32.6%</td>
<td>56%</td>
</tr>
<tr>
<td>Data Quality</td>
<td>55%</td>
<td>69.8%</td>
<td>72%</td>
</tr>
<tr>
<td>Use of Information</td>
<td>57%</td>
<td>74.2%</td>
<td>84%</td>
</tr>
</tbody>
</table>

*Source: Center for Data and Information, Ministry of Health, 2017*

Based on the conditions mentioned above, a project, funded by a Global Fund Health System Strengthening (GF HSS) grant given to the Ministry of Health, began on July 1, 2016 and ended on June 30, 2018. The objectives of the project were to assemble conclusive evidence that would convince district and city leaders to invest more in national policies, instruments, and standards related to HIS, in order to promote and market the instruments and standards of HIS to regional leaders. The working areas were in ten districts in five provinces: Sumatera Utara (Deli Serdang & Labuhanbatu), Jawa Timur (Malang & Tulungagung), NTB (Lombok Barat & Lombok Timur), Sulawesi Selatan (Kota Makassar & Kota Pare-pare), and Maluku (Kota Ambon & Seram Bagian Barat), where each district or city has ten Health Centers (*Puskesmas*). The project is a district-focused approach that characterized by six indicators: 1) Availability of independent HIS assessments in districts, 2) Availability of HIS activities approved by the District Health Office, 3) Availability of demonstration dashboards in the district, 4) Availability of six monthly reports/dashboards for each semester in the district, 5) Availability of evaluation reports of each district, and 6) Availability of completed HIS modules with lessons learned from each district.

The objective of the study is to evaluate whether the district-focused approach could improve HIS performance in ten districts in five provinces in Indonesia. The research questions were as follows:

What are the factors that support HIS strengthening?

How can the remaining issues be solved and the strengthening of HIS continued after project termination?

**Method**

The method used in this evaluation study used two approaches:

Health Metric Network framework from WHO

System Success Model from DeLone and McLean

Health Metric Network Framework from WHO

The HMN framework that measured HIS strengthening quantitatively has six components, namely HIS resources, indicators, data sources, data management, information product, and dissemination/data use. The HIS components and the parameters in detail can be seen in Table 2. This framework has been used previously by the Ministry of Health in assessing the National HIS in 2007, 2012, and 2016. The framework is equipped with self-assessment tools to measure the development of HIS, which were used at the beginning of the project and after project termination.
Table 2. The Components and Parameters of HIS

<table>
<thead>
<tr>
<th>Components</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIS Resources</td>
<td>• Regulation/policy, planning</td>
</tr>
<tr>
<td></td>
<td>• Institutions, human resources</td>
</tr>
<tr>
<td></td>
<td>• Financing</td>
</tr>
<tr>
<td></td>
<td>• Infrastructure</td>
</tr>
<tr>
<td>Indicator</td>
<td>• Main indicator</td>
</tr>
<tr>
<td>Data Sources</td>
<td>• Census</td>
</tr>
<tr>
<td></td>
<td>• Vital statistics</td>
</tr>
<tr>
<td></td>
<td>• Survey in population</td>
</tr>
<tr>
<td></td>
<td>• Disease and health records</td>
</tr>
<tr>
<td></td>
<td>• Health care records</td>
</tr>
<tr>
<td></td>
<td>• Health administrative records</td>
</tr>
<tr>
<td>Data Management</td>
<td>• Data management procedure</td>
</tr>
<tr>
<td>Information Product</td>
<td>• Health status indicators</td>
</tr>
<tr>
<td></td>
<td>• Health system indicators</td>
</tr>
<tr>
<td></td>
<td>• Risk factors</td>
</tr>
<tr>
<td>Dissemination and Data Use</td>
<td>• Analysis and information use</td>
</tr>
<tr>
<td></td>
<td>• Information use for policy and advocacy</td>
</tr>
<tr>
<td></td>
<td>• Information use for priority determination</td>
</tr>
<tr>
<td></td>
<td>• Information use for planning and action</td>
</tr>
</tbody>
</table>

System Success Model from DeLone and McLean

The study assessed components of the System Success Model, namely system quality, information quality, and service quality, as well as the net benefits of individual and organizational impact, as seen in Figure 1.

Figure 1. System Success Model

The key instrument used to measure system success was a structured checklist, which consisted of determinants of success (system quality, service quality, and information quality) and net benefits (for individuals and organization). The evaluation of system success was conducted at the end of project.

The HIS study evaluation was carried out in the ten districts mentioned in the background.
Results

Increased HIS Performance

Self-assessments for the framework developed by the WHO were carried out at the beginning and end of the project to see how far HIS strengthening had progressed in each district. The study revealed increases in each component of the HIS in all ten districts of the project working areas between the initial assessment results in early 2017 and the end of the project in May 2018. Strengthening occurred in HIS resources, health indicators, data sources, data management, data quality, and use of information (see Figure 2). However, these components have not been fully optimized. There is still considerable room for further HIS strengthening.

Figure 2. Results of HIS strengthening self-assessment pre-and post-project

The study also found there was an effort to ensure the sustainability of HIS strengthening in the form of local government commitments (memoranda of understanding [MoU]). Table 3 shows the commitments generated by the project.

Table 3. Outcomes of Commitments

<table>
<thead>
<tr>
<th>Province/district</th>
<th>Mayor regulation on HIS</th>
<th>MoU of HIS implementation</th>
<th>Decree on HIS team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sumatera Utara Province</td>
<td>Mayor regulation on District Health Information System</td>
<td>MoU on HIS Strengthening of Sumatera Utara Province in 2018</td>
<td>543/2017</td>
</tr>
<tr>
<td>Deli Serdang</td>
<td></td>
<td></td>
<td>440.000/1339/III/2017</td>
</tr>
<tr>
<td>Labuhanbatu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NTB Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lombok Timur</td>
<td>Mayor regulation on District Health Information System</td>
<td>District Health Office commitment to One Health Data implementation (DHIS2)</td>
<td>854/012/KES/2017</td>
</tr>
<tr>
<td>Lombok Barat</td>
<td>Mayor regulation on District Health Information System</td>
<td>District Health Office commitment to One Health Data implementation (DHIS2)</td>
<td>045/02.1/UPTD-Datin/I/2016</td>
</tr>
<tr>
<td>Sulawesi Selatan Province</td>
<td>Mayor regulation on District Health Information System</td>
<td></td>
<td>870/40.2/DKK/I/2017</td>
</tr>
<tr>
<td>Makassar</td>
<td>Mayor regulation on District Health Information System</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The System was Successful and Useful

The system success assessment involved all health workers who were involved in the HIS implementation, both at the *Puskesmas* and program managers at the district and provincial health offices. During the evaluation process (discussions and field visits) in ten districts, 187 respondents were involved through mini workshops in the districts and field visits to *Puskesmas* (Figure 3).

Most participants reported that HIS strengthening was successful and useful, with 89% improvement in system quality, 85% in information quality, 93% in service quality, 96% in individual impact, and 89% in organizational impact. Nevertheless, there are still data completion issues, in that users cannot use data from one system to another, and the district funding for HIS is still limited. See the detail in Table 4.

### Table 4. Results of System Success Evaluation

<table>
<thead>
<tr>
<th>Indicators</th>
<th>%</th>
<th>Sub Component</th>
<th>Description</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Quality</td>
<td>89%</td>
<td>*Sub component Data completeness = 75%</td>
<td>Users feel they have not received complete data in accordance with job requirements</td>
<td>Indicators are limited/ manual reports more completed</td>
</tr>
<tr>
<td>Information Quality</td>
<td>85%</td>
<td>*Sub component Format of output = 76%</td>
<td>Users cannot use data from one system to another system</td>
<td>Don’t know/ haven’t used it/ can’t at all</td>
</tr>
<tr>
<td>Service Quality</td>
<td>93%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual Impact</td>
<td>96%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational Impact</td>
<td>88%</td>
<td>*Sub component “Productivity gain” = 74%</td>
<td>The district funding for HIS is still limited</td>
<td>Implementation is not working properly/Lack of infrastructure</td>
</tr>
</tbody>
</table>
Discussion

What factors support the achievements of HIS strengthening?

A direct impact of this project has been success in strengthening all HIS components in all districts. All key performance indicators reached 100% by the end of the project, where this might be the success factors in strengthening all HIS components, and the factors are as follows:

HIS self-assessment is complete in all selected districts and the results report has been distributed to relevant stakeholders.

The HIS activity plan has been prepared and approved by the Health Office, and the documents have been distributed to all stakeholders through workshop launchings in each district.

Demonstration dashboards are available in every district.

Each semester, six monthly reports are available on the dashboard in all selected districts.

The evaluation report was successfully completed in full and is available.

The HIS module has been completed, and is complete with lessons learned from each district to disseminate.

These six success factors would be a lesson for HIS strengthening in other districts in Indonesia.

How can the remaining issues be solved, and the strengthening of HIS continued?

The main challenge faced after termination of the HIS strengthening project was the completion of funding obtained for the project. However, during the implementation of project, there were efforts to establish commitments from district-level governments to ensure sustainability of HIS strengthening. There have been different forms of commitment from various districts, which include mayoral regulation of HIS, memoranda of understanding for HIS implementation, and a decree for an HIS team. These forms of commitment have an impact on funding and the use of resources from each district to continue HIS strengthening. The following are recommendations to continue HIS strengthening:

Components for the strengthening of HIS must be kept in focus, especially data quality improvement\(^1\).

Program activities that strengthen HIS must be continuously conducted\(^2\).

The HIS strengthening program coverage must be expanded to other districts and *Puskesmas*.

Organization of strengthening programs must be established in district health offices (DHOs) and provincial health offices (PHOs).

Funding mobilization for the strengthening of HIS programs must be initiated\(^3\).

Conclusions

A district-focused approach to strengthening Indonesia’s HIS has increased the functionality of each HIS component. Most health workers reported that the HIS strengthening was successful and useful in all ten districts of the project, which was demonstrated by evaluation using the HMN framework and System Success Model.

Factors that support the achievements of district-level HIS strengthening consist of HIS self-assessments, HIS activity plans, demonstration dashboards, monthly reports, evaluation reports, and HIS modules. These are district-level key performance indicators that reached 100% by the end of the project.

The remaining issues could be solved, and the strengthening of HIS could be continued, as a number of districts have identified potential resources and funds. The specific recommendations already mentioned must be kept in focus, especially data quality improvement.

Acknowledgment: This study was done by referring to the evaluation report and final report of the HIS strengthening project of the Indonesian Ministry of Health, which funded by the Global Fund Health System Strengthening. Special gratitude is conveyed to the Indonesian Ministry of Health’s Center for Data and Information, to the Provincial and District Health Offices, and to the *Puskesmas* involved in the project, as well as to the Global Fund.

Conflict of Interest Statement: The authors declare that there is no conflict of interest related to this study.

Ethical Clearance: Ethical clearance for this
research was received from the Ethics Committee of the Faculty of Public Health, Universitas Indonesia.

**Source of Funding:** This is a self-funded study.

**References**


Job Stress and Stroke among Employees in Thailand: Preliminary Findings from a Case-Control Study

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Abstract

Stroke is considered a vital public health issue on the global, Thailand including. Thailand has a higher tendency for stroke and comes across the working age numerically. This case control study was conducted to study the association between job stress and stroke. The cases are twenty first-time stroke patients within a one-month period. The controls are twenty working age people who have never admitted to stroke. Pair-matched with gender, age and work characteristics between cases and controls are used to select the samples. The subjects in both groups must have had work experience for at least 6 months before admitting to stroke. The job demand control model is used to evaluate the job stress. Association between stroke and job stress is analyzed using logistic regression statistics. The result reveals that subjects with high job demands were 3.36 times more likely to develop stroke than those with low job demands (OR=3.36, 95% CI=1.03 – 11.12) after adjusting for age, marital status, education, smoking, alcohol drinking, exercise, hypertension, and BMI.

Keywords: job stress, job demand, job control, stroke, working age, Thailand

Introduction

Stroke is considered one of many vital public health issues, given its direct and indirect medical costs and global burden of this disease. All over the world, stroke incidences and death rates have showed a tendency of rising. This holds true in Thailand, too, even if there are prevention campaigns against stroke in place in recent years. Stroke is the leading cause of death among working age population in Thailand for years according to official statistical data. Stroke affects not only patients but also their families regarding the expenses and attendance which impacts their economic conditions.

The common risk factors for stroke are composed of genetics factors, environmental factors, and human factors (i.e. high blood pressure, diabetes, hyperlipidemia, heart disease, smoking, alcohol drinking, and exercise). Currently, an association between psychosocial factors and cerebrovascular disease has been reported. In the workplace, the job Demand-Control model is the most widely used model to measure psychosocial factors at work. There are two major components in terms of job demand and job control, and job stress is speculated by a combination of high job demand and low job control which is harmful to health. To the best of our knowledge, no study on job stress and stroke has been reported in Thailand so far. Therefore, this current study aimed to assess the association between job stress and stroke, for the first time in this country. The gained scientific evidence would be useful to policymakers with respect to stroke prevention, particularly among working age population.

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Method

This was a 1:1 matched case-control study. The control and case were randomly selected simultaneously. Cases were recruited at a stroke unit and a stroke clinic from one hospital in Bangkok.

Case

The cases were male and female patients with a first-time diagnosis incident for stroke diagnosed by a neurologist or neurosurgeon with ICD 10 I60-I69 and GR49.5 codes. The inclusion criteria are as follows: be an employee, be between the ages of 20-59 years old, and be able to write, read, and have a conversation. The exclusion criteria include patients who have had recurrent stroke events, were clinically unstable, unable to communicate, or had major mental disorder(s). The cases were recruited to participate in the study by nurses within a period of 1 month after being discharged. There were 20 cases who completed the questionnaires.

Control

Controls were selected by pair-matching to the cases, with gender, age and employment conditions. The inclusion criteria include working in the same area of expertise or working at the same places as the cases, same gender, and same age plus/minus three years. The exclusion criteria were history of stroke, heart disease or cancer. The study nurses contacted the controls and conducted the surveys. There were 20 controls who completed the questionnaires.

Data Collection

All data was collected by self-administered questionnaires consisting of the following parts;

Personal information

Personal information contained sex, age, marital status, average income, accommodations, weight, height, education, medical records, family history of stroke, health behavior in the last 6 months period (i.e. alcohol drinking, smoking and exercise.)

Employment conditions

Employment conditions asked the participants’ occupation, position, working year, working hours, and shift work.

Job Stress

To evaluate job stress, the Thai version of the Job Content questionnaire was used, including a 5-item scale of job demand and 9-item scale of job control, with response categories from Strongly Agree, Agree, Disagree, to Strongly Disagree. Cronbach’s Alpha Coefficients of job demand and job control scales were 0.60 and 0.83, respectively, indicating acceptable reliability. The subjects were divided into high group or low group for job demand and job control by using median scores as cutoff points. Then, four classifications of jobs were classified by combinations of job demand and job control as followed;

1. Low strain job (low demand, high control)
2. Passive job (low demand, low control)
3. Active job (high demand, high control)
4. High strain job (high demand, low control)

Data Analysis

Firstly, descriptive statistics was performed to calculate frequency, percentage, mean, and standard deviation. Secondly, associations between job stress and stroke were analyzed using Logistic Regression. The results were expressed with odds ratios (ORs) together with 95% confidence intervals (CIs), and significance was set at p=0.05.

Results

General characteristics of the subjects are shown in Table 1. For the case, 60% were female, 35% were between the ages of 40-49 years old, 40% were single, 45% were married and 75% earned bachelor’s degrees or higher. For the control, 70% were female, 45% were between the ages of 40-49 years old, 80% were married and 95% graduated with bachelor’s degrees.

Table 2 shows employment conditions and psychosocial work characteristics of the subjects. Among the cases, 70% were staff, 75% worked with no shift, and 60% had average working hours less than 48 hours per week. For the controls, 65% were staff, 70% worked with no shift and 70% had average working hours less than 48 hours per week. Thirty percent of the cases were classified as high job demand and 70% as low job control, while 35% of the controls were classified as high job demand and 75% as high job control. Twenty-
five percent of the cases reported their job type as high strain, active, passive, or low strain, respectively. The controls reported their job type as high strain, active, passive, and low strain at 20%, 45%, 20% and 15% respectively.

The results of this study found some preliminary associations between job stress and stroke. Logistic regression analyses indicated potentially meaningful associations between job demand and stroke after adjusting for age, marital status, education, smoking, alcohol drinking, exercise, hypertension and BMI. The odds of stroke were 3 folds higher when job demand increased per 1 unit. Job control demonstrated a tendency as a protective factor (OR = 0.26) with wide CI. We did not observe meaningful associations of four-category job stress with stroke due to extremely wide CIs (Table 3).

Table 1 General characteristics of cases and controls

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>8(40)</td>
<td>6(30)</td>
</tr>
<tr>
<td>Female</td>
<td>12(60)</td>
<td>14(70)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td>7(35)</td>
<td>6(30)</td>
</tr>
<tr>
<td>40-49</td>
<td>7(35)</td>
<td>9(45)</td>
</tr>
<tr>
<td>50-59</td>
<td>6(30)</td>
<td>5(25)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>9(45)</td>
<td>16(80)</td>
</tr>
<tr>
<td>Single</td>
<td>8(40)</td>
<td>3(15)</td>
</tr>
<tr>
<td>Divorced/separated/ widowed</td>
<td>3(15)</td>
<td>1(5)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary school</td>
<td>1(5)</td>
<td>0(0)</td>
</tr>
<tr>
<td>Junior high school</td>
<td>2(10)</td>
<td>1(5)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>9(45)</td>
<td>12(60)</td>
</tr>
<tr>
<td>Higher Bachelor’s degree</td>
<td>6(30)</td>
<td>7(35)</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>13(65)</td>
<td>19(95)</td>
</tr>
<tr>
<td>Yes</td>
<td>7(35)</td>
<td>1(5)</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>20(100)</td>
<td>20(100)</td>
</tr>
<tr>
<td>Yes</td>
<td>0(0)</td>
<td>0(0)</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>14(70)</td>
<td>17(85)</td>
</tr>
<tr>
<td>Yes</td>
<td>6(30)</td>
<td>3(15)</td>
</tr>
<tr>
<td>Exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irregular</td>
<td>15(75)</td>
<td>14(70)</td>
</tr>
<tr>
<td>Regular</td>
<td>5(25)</td>
<td>6(30)</td>
</tr>
<tr>
<td>Alcohol drinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>12(60)</td>
<td>13(65)</td>
</tr>
<tr>
<td>Yes</td>
<td>8(40)</td>
<td>7(35)</td>
</tr>
</tbody>
</table>
Table 2: Employment conditions and psychosocial work characteristics of cases and controls

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cases n (%)</th>
<th>Controls n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Job position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>6(30)</td>
<td>7(35)</td>
</tr>
<tr>
<td>Staff</td>
<td>14(70)</td>
<td>13(65)</td>
</tr>
<tr>
<td><strong>Work shift</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>15(75)</td>
<td>14(70)</td>
</tr>
<tr>
<td>Yes</td>
<td>5(25)</td>
<td>6(30)</td>
</tr>
<tr>
<td><strong>Working hour/ week</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤48</td>
<td>12(60)</td>
<td>14(70)</td>
</tr>
<tr>
<td>&gt;48</td>
<td>8(40)</td>
<td>6(30)</td>
</tr>
<tr>
<td><strong>Job type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High strain job</td>
<td>5(25)</td>
<td>4(20)</td>
</tr>
<tr>
<td>Active job</td>
<td>5(25)</td>
<td>9(45)</td>
</tr>
<tr>
<td>Passive job</td>
<td>5(25)</td>
<td>4(20)</td>
</tr>
<tr>
<td>Low strain</td>
<td>5(25)</td>
<td>3(15)</td>
</tr>
<tr>
<td><strong>Job demand</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>6(30)</td>
<td>7(35)</td>
</tr>
<tr>
<td>Low</td>
<td>14(70)</td>
<td>13(65)</td>
</tr>
<tr>
<td>Mean(SD)</td>
<td>12.9(2.8)</td>
<td>12.5(1.9)</td>
</tr>
<tr>
<td>Min-max</td>
<td>7-19</td>
<td>6-14</td>
</tr>
<tr>
<td><strong>Job control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>6(30)</td>
<td>5(25)</td>
</tr>
<tr>
<td>Low</td>
<td>14(70)</td>
<td>15(75)</td>
</tr>
<tr>
<td>Mean(SD)</td>
<td>26.3(2.7)</td>
<td>26.8(1.2)</td>
</tr>
<tr>
<td>Min-max</td>
<td>21-31</td>
<td>25-29</td>
</tr>
</tbody>
</table>

Table 3: Associations between job stress and stroke among employees in Thailand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjust ORs (95% CIs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job demand (continuous variable, increase per 1 unit)</td>
<td>3.36 (1.03-11.12)**</td>
</tr>
<tr>
<td>Job control (continuous variable, increase per 1 unit)</td>
<td>0.28 (0.04-1.74)</td>
</tr>
<tr>
<td>Job stress Low strain job</td>
<td>1 (Reference)</td>
</tr>
<tr>
<td>Passive job</td>
<td>285.27 (0.08-10244.77)</td>
</tr>
<tr>
<td>Active job</td>
<td>11.24 (0.05-2339.86)</td>
</tr>
<tr>
<td>High strain job</td>
<td>2.53 (0.01-584.66)</td>
</tr>
</tbody>
</table>

Logistic regression, adjusted for age, marital status, education, smoking, alcohol drinking, exercise, hypertension and BMI.

**p<0.01
Discussion

The aim of this study was to examine the associations of job stress and stroke in Thailand, using standard and valid questionnaire with case-control study design. For this first time, the preliminary results of our study found potential associations, in particular, to job demand being related to a 3-time higher odds of stroke, after taking relevant covariates into account. However, job control and job strain did not reach the significant level to be associated with stroke in our study sample, due to wide CIs.

In recent years, two independent reviews synthesized available evidence of prospective cohort studies, indicating that job strain (combination of high job demand and low job control) was associated with higher risk of stroke, especially ischemic stroke. However, it needs to note that most studies were conducted in Europe. Whether job stress increases the risk of stroke is largely unknown in Asia. One large prospective cohort study in Japan deserves special attention. It revealed that job strain was also associated with more than a 2-time higher risk of incident stroke among Japanese male employees. In addition, the protective role of job control is completely testified, according to our preliminary results which is inconsistent with evidence from the western world. On one hand, due to the small sample size, though we observed a tendency of protective effects of job control (OR = 0.28), the effect size did not reach a significant level. On the other hand, the difference may be explained by cultural differences. As indicated by previous cross-cultural research, stressful experiences in the workplace might differ between members from Asian and European populations in consideration of cultural norms which could have an important effect on perception of stressors at work. This explanation of cultural difference is supported by a recent large study from Thailand that job control was not significantly associated with arterial stiffness, a strong clinical predictor of stroke, among Thai workers.

Nevertheless, our study had some limitations. First, our sample size was very small, most of the preliminary findings are underpowered, given the wide CIs of regression analyses. Enlarging the sample size would be helpful for further research. Second, we were not able to conduct stratified analyses to test the gender difference, and differential effect on subtypes of stroke (ischemic vs. hemorrhagic) as suggested by earlier studies. Third, in addition to the job Demand-Control model, other stressors in the workplace should be considered in future. For instance, a recent case-control study from Sweden found that imbalances between efforts spent and rewards received, as well as conflict at work might serve as important risk factors of stroke too.

Conclusion

In conclusion, as the first study in Thailand, our preliminary findings suggest job demand is associated with higher odds of stroke among Thai employees. The results suggest that interventions aiming at improving work structure and job redesign might be useful for job stress reduction. The worksite health promotion should be considered for integration with stroke prevention programs in Thailand.

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Conflict of Interests : The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Clearance: This study protocol was approved by the Ethical Committee of Human Research Protection Unit, Faculty of Medicine, Siriraj Hospital, Mahidol University, Thailand (COA. No. SI 304/2018). All participants gave their written informed consent.

Source of Funding: Self

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5. Singphoo K, Tiankao S, Ariyanuchikul S,


The Relationship Between Job Stress and Tinnitus among Workers in Expressway Authority of Thailand

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Abstract

This cross-sectional study aims to examine the relationship between job stress and tinnitus. The subjects consisted of 183 workers of Expressway Authority of Thailand. Data was collected using self-administered questionnaires pertaining to personal information, working conditions, job stress, and tinnitus symptoms. The relationship between job stress and tinnitus was analyzed by multiple logistics regressions. The findings revealed that 16.9% of workers had tinnitus. Twenty percent of the subjects reported high job strain. Multiple logistic regression analysis indicated that job stress significantly correlates with tinnitus. The results suggest that the intervention aiming at the prevention of tinnitus from job stress in workers of Expressway Authority of Thailand should be taken into consideration.

Keywords: Workers of Expressway Authority of Thailand / Tinnitus / Job stress

Introduction

Tinnitus, or the perception of sounds in the absence of an external source, is one of the hearing problems in the adult population. Tinnitus can cause difficulties with concentration, reduced speech intelligibility, and interpersonal problems which affects people’s lifestyle and quality of life. The prevalence of tinnitus in the adult population is approximately 8-15%.

Tinnitus often occurs together with hearing loss and may share the same risk factors as hearing loss, including occupational noise exposure, chemical, drug, head injury, ear diseases, and socioeconomic factors. Previous studies suggest that tinnitus is an early sign of noise induced hearing loss; however, tinnitus can occur in individuals with normal hearing.

Psychological stress has been reported as a risk factor. Previous studies report the association between psychological stress and tinnitus after a control variable of noise exposure among bus drivers and nurses. Two studies from Sweden reported that job insecurity and burnout were significantly related to tinnitus; however, a study from Denmark did not find any relationship between tinnitus and psychosocial working conditions; therefore, further studies need to be conducted to clarify the relationship between stress and tinnitus.

Working environment has been recognized as a major source of stress in adult life. Currently, three theory-based models, i.e., the job strain model, the effort-reward imbalance model, and the organizational injustice model are mainly used to define the stressful work environments. In this study, job strain model is used to define job stress.

Workers of the Expressway Authority of Thailand (EAT) had to perform their work under risky psychosocial conditions. They must be in the toll booth with limited space for movement, worked in the same manner repeatedly and continuously with the cyclical task, less opportunity to talk to colleagues, doing shift work, exposed to a variety of health threats from work including traffic noise, and exhaust chemicals. These factors might cause workers to suffer from job stress.

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According to the results of the annual health check in 2017, it was found that the EAT workers had a prevalence of hearing loss of about 38%\(^{15}\); however, no prevalence of tinnitus was reported. This study aims to examine job stress and prevalence of tinnitus and investigate the relationship between job stress and tinnitus among the EAT workers.

**Method**

**Study population**

This cross-sectional study was conducted from January to June 2017. A total of 183 workers of EAT who were aged 18 years or over, been working for at least 1 year, and has never been diagnosed with a hearing impairment by physician were recruited. Sample size was calculated by using of proportion value of hearing impairment from previous research which was 0.38\(^{15}\) and the maximum tolerability of error value equaled to 0.05.

The subjects were asked to complete the questionnaire which included the questions of age, gender, education, income, occupational history, working condition, noise exposure, and other risk factors of hearing, job stress, and bothersome tinnitus.

Job stress was assessed using the Thai-JCQ questionnaire developed by Baker and Karasek,\(^{16}\) consisting of questions including 5 questions on job demand and 9 questions on the job control. The questionnaire was a rating scale with 4 levels, namely; least agree, less agree, more agree, and most agree. The reliability value analyzed by using of Cronbach’s alpha Coefficient was equaled to 0.81.

Tinnitus in this study was defined by a “yes” response to the single question: “Have you during the most recent time experienced sound in any of the ears, without there being an external source (so-call tinnitus) lasting more than 5 min?”\(^{10}\) A no response and missing values were considered equivalent to “not bothered”.

**Statistical Analysis**

General data was analyzed using descriptive statistics; frequency, percentage, mean, and standard deviation. Relationship between job stress and tinnitus was analyzed using Logistic Regression Analysis.

**Results**

Characteristics of the subjects are shown in Table 1. The mean age of the subjects is 40.4 years (standard deviation [SD] = 8.4). About 53.0% of the subjects were older than 40 years, 52.5 % were male, 70.5% were married and 24.6% had monthly income less than 500 USD. About half of the subjects (51.9%) had working experience of more than 10 years. Only 2.7% of the subjects worked more than 48 hours per week and 48% work at toll booth. Twenty percent reported exposure to chemicals at work, 7.7 % reported exposure to noise at work, 13% used ototoxic drug and had hearing loss in family. About 54.6% used no hearing protective equipment and 58.5% used headphones for music listening. Twenty percent reported high strain job and 16.9% reported having tinnitus.

<table>
<thead>
<tr>
<th>Table 1. Characteristics of the Subjects.</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt;40 years</td>
<td>97 (53.0)</td>
</tr>
<tr>
<td>Male</td>
<td>96 (52.5)</td>
</tr>
<tr>
<td>Married</td>
<td>129 (70.5)</td>
</tr>
<tr>
<td>Income &lt;500 USD</td>
<td>45 (24.6)</td>
</tr>
<tr>
<td>Service experience &gt;10 years</td>
<td>95 (51.9)</td>
</tr>
<tr>
<td>Work more than 48 hours per week</td>
<td>5 (2.7)</td>
</tr>
<tr>
<td>Toll booth job</td>
<td>88 (48.1)</td>
</tr>
<tr>
<td>Exposed to chemical at work</td>
<td>37 (20.2)</td>
</tr>
<tr>
<td>Exposed to loud noise at work</td>
<td>14 (7.7)</td>
</tr>
<tr>
<td>Used ototoxic drug</td>
<td>24 (13.1)</td>
</tr>
<tr>
<td>Hearing loss in family</td>
<td>24 (13.1)</td>
</tr>
<tr>
<td>No hearing protective</td>
<td>100 (54.6)</td>
</tr>
<tr>
<td>Used headphones for music listening</td>
<td>107 (58.5)</td>
</tr>
<tr>
<td>High strain job</td>
<td>37 (20.2)</td>
</tr>
</tbody>
</table>

Figure 1 shows the prevalence of study variables for the tinnitus and the non-tinnitus groups. The prevalence of high strain job, and experienced otitis were significantly higher in the tinnitus group than in the non-tinnitus group.
Multiple logistic regression analysis showed association between tinnitus and job stress after adjusting for age, income, work year, otitis, ototoxic drug, occupational noise exposure and occupational chemical exposure (Table 2). The workers who reported high strain job was estimated to be tinnitus 6.98-fold (95% CI: 1.04-46.73) higher than those with no high strain job.

**Table 2 Association between tinnitus and job stress in workers of the Expressway Authority of Thailand**

<table>
<thead>
<tr>
<th>Factors</th>
<th>OR (adjusted)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>High strain job</td>
<td>6.98</td>
<td>1.04-46.73*</td>
</tr>
<tr>
<td>Used headphones for music listening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No hearing protective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hearing problem in family</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experienced otitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used ototoxic drug</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed to loud noise at work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed to chemical at work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toll booth job</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service experience &gt;10 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income &lt;500 USD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age &gt;40 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Logistic regression, adjusted for age, income, work year, otitis, ototoxic drug, occupational noise exposure and occupational chemical exposure

*p<0.05

**Discussion**

The findings show that 16.9% of Expressway Authority of Thailand workers suffered from tinnitus. Multiple logistic regression analysis showed association between tinnitus and job stress after adjusting for age, income, work year, otitis, ototoxic drug, occupational noise exposure and occupational chemical exposure.

The prevalence of tinnitus among Expressway Authority of Thailand workers (16.9%) in this study was close to the results found for Thai male bus drivers (15.4%), Chinese female hospital nurses (13.2%)\(^3\) and adult population (8%-15%)\(^4\). Thus, tinnitus seems to be one of the more common problems among the working population including the Expressway Authority of Thailand workers.

Currently, the association between stress and tinnitus has been reported. Workers perceiving high job stress have in increased risk of tinnitus.\(^{17,18}\) In adult life, work environment has been considered as major source of stress, especially in a psychosocial work environment. This study found that workers who reported high strain jobs were estimated to be tinnitus 6.98-fold (95% CI:
1.04-46.73) when compare with those with no high strain job. This result is similar to previous studies in Thai male bus drivers and Chinese female hospital nurses which reported the association between psychological work environment and tinnitus. It also confirms prior Western studies on the association between job stress and tinnitus.

The mechanism of stress contribution to the onset of tinnitus remains unknown. However, there is a potential mechanism based on psychophysiological evidence that has been proposed, i.e., glutamate-related neuroplasticity in the auditory system is induced by stress.

Chronic stress exposure seems to be harmful to hearing. A normally functioning hypothalamic-pituitary-adrenal axis is a requirement for hearing. This exhaustion, the inability to face stress normally, of the hypothalamic-pituitary-adrenal axis has important clinical consequences, being a risk for auditory dysfunctions such as tinnitus. Nevertheless, our study has some limitation. First, the study was cross-sectional which cannot directly explain causes of tinnitus from stress. Second, a single question to define tinnitus was used without further clarification as to what tinnitus refers to which may have some misconception about the term tinnitus.

Conclusion

Prevalence of tinnitus among Expressway Authority of Thailand workers was 16.9%. This study found an association between job stress and tinnitus. The results suggest that the intervention aiming at the prevention of tinnitus from job stress in workers of Expressway Authority of Thailand should be taken into consideration.

Acknowledgment: The authors would like to thank all the Expressway Authority of Thailand workers who participated in this study. This study was partially supported for publication by Faculty of Public Health, Mahidol University.

Conflict of Interests: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Clearance: The study protocol was approved by the Human Ethics Committee at Faculty of Public Health, Mahidol University, Thailand (COA. No. MUPH 2018-007). All participants gave their written informed consent.

Source of Funding: Self

References


Body Mass Index is an Independent Predictor for Mediastinitis Post Coronary Artery Bypass Graft Surgery in Indonesia

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Abstract

Objective: to determine optimal cut-off of body mass index (BMI) as a predictor for mediastinitis post coronary artery bypass graft (CABG) among Indonesia population.

Method: A retrospective cohort study of patients received CABG surgery at Cipto Mangunkusumo Referral Hospital in Jakarta from January 2011 to December 2017. Mediastinitis were defined according to Center for Disease Control (CDC) definition.

Result: Among 706 patients, mediastinitis has been found in 35 patient (4.96%). BMI in patient with mediastinitis were significant higher than those without mediastinitis. The receiver operating characteristic (ROC) curve for BMI had an area under the curve of 0.6701 (95% CI 0.6339-0.7046). BMI at a cut-off 26.50 kg/m² with its sensitivity (62.86 %) and specificity (66.17 %). Multivariate analysis using obesity definition based on ROC has an adjusted OR 3.34 (95% CI 1.61-6.97). While use WHO Obesity classification has incremental adjusted odds ratio of 3.23 for overweight category rose to 4.03 for obese.

Conclusion: BMI can be used to predict mediastinitis post CABG in Indonesian population. The optimal cut-off point of BMI as a predictor is 26.5 kg/m². Overweight has three times and obese has four times risk for mediastinitis.

Keywords: body mass index, mediastintis, coronary artery bypass graft.

Introduction

Overweight and obesity has increased rapidly in all over the world including in developing countries. Overweight and obesity are associated with many burden diseases such as type 2 diabetes mellitus, high blood cholesterol level, high blood pressure and coronary heart diseases and its economic impact are significant higher in obese population. The National basic health research 2007 had shown that the prevalence of obesity among Indonesia adult people was about 23.1%.

Obesity correlated to wound healing impairment has been postulate by some pathways i.e. poor vascularity of adipose tissue, positive correlation to oxidative stress mechanism, cellular and molecular alteration, macronutrient and micronutrient deficiencies and many other mechanism.

Mediastinitis according to CDC definition is an infection occurred in mediastinal space and meets one of the criteria i.e. organism identified from mediastinal tissue or fluid, evidence on gross anatomic and histopathologic exam, fever, chest pain and or sternal instability, and purulent drainage from mediastinal area or mediastinal widening on imaging test. The incidence rate of mediastinitis post coronary artery bypass graft (CABG) surgery is around 2.4%-5.6%.

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is a serious complication related to cost, mortality and morbidity.\textsuperscript{10,11} Length of stay patient with mediastinitis was three times and ICU length of stay was nine times than non mediastinitis patient.\textsuperscript{11} Hollenbeck et al (2000) were studied on economic impact found that patient with mediastinitis need $US 18,938 additional cost in first operating year than patient non mediastinitis.\textsuperscript{12}

D’agostino et all (2015) identify that microorganism responsible for this infection commonly from patient skin and or healthcare hands contamination.\textsuperscript{13} Gram positive cocci, especially staphylococci are two third kind of microorganism found in mediastinitis and the rest are gram negative or polymicrobial infection.\textsuperscript{11} Chang and Wang (2004) found 8 out of 16 (50%) microorganism isolated from the wound were \textit{Staphylococcus aureus} and all were methicillin resistant, and 44% (7/16) were coagulase negative \textit{Staphylococcus}, and only one isolate from gram negative bacteria \textit{Klebsiella pneumoniae}.\textsuperscript{10}

Many predictors identified predisposing the mediastinitis post CABG, which can be divided into three groups i.e. preoperative, intraoperative and post-operative factors. In preoperative, there were obesity, age, diabetes mellitus, smoke and chronic obstructive pulmonary disease. Intra and post-operative include duration of surgery, grafting both left and right interna mammary artery, antibiotic prophylaxis, delay sternal closure, sternotomy intervention for surgical bleeding, mechanical ventilation duration.

BMI as a measurement of obesity although have a bias effect in measuring health outcome \textsuperscript{14}, now used by WHO and Central Disease Control (CDC) for classifying obesity.\textsuperscript{13} Obesity as a predictor for mediastinitis was described in any study. Using obese definition (BMI > 30 kg/m\textsuperscript{2}) Oliveira SA et all (2011) on their study at Pronto Socorro Cardiológico de Pernambuco Brazilia, Study at Duke University Medical Center (1995) Italia , Parisian Group (1996) in Paris found obesity is an independent variable in multivariate logistic regression.\textsuperscript{7,9,16} A study from Taiwan identified that patients with mediastinitis has BMI 24.7 ±3.79 kg/m\textsuperscript{2} and without mediastinitis has BMI 25.3±3.23 kg/m\textsuperscript{2} but there is no significant difference between group (p=0.446).\textsuperscript{10} Very limited study explain the risk of overweight to mediastinitis and are there any dose response among its obesity stratification.

\textbf{Method}

This was a retrospective cohort study comprised of 706 consecutive patient from January 2011 until December 2017. This study was conducted in Cipto Mangunkusumo National Referral Hospital in Indonesia. Inclusion criteria were patient ≥18 years of age with on pump CABG surgery. Patient with Kawasaki disease diagnostics prior to surgery and patient die ≤48 hours after surgery were excluded. Data retrieved from infection control surveillance of its institution confirmed with patients manual and or electronic patients health record.

According to CABG surgery clinical pathway, patients were admitted a day before the day of surgery, patient took chlorhexidine bathing on the evening and morning prior to surgery. Hair was removed with clipper morning before surgery. Most patients received cephalosporin first generation as antibiotic prophylaxis except whose allergy, vancomycin will replace. The dose is 1-2 grams bolus base on patient BMI, administered half until an hour before incision Antibiotic will be re-dose if procedure more than 4 hours and will be continued 48 hours post-surgery. Wound was examined by surgeon at first 72 hours then every day post-surgery. Patients were sent back to referrer hospital at least after twice control in outpatient clinic without any sign of wound infection. Definition of mediastinitis according to Central Disease Control\textsuperscript{6} and diagnosed by surgeon. Superficial wound infection were not classified as a mediastinitis.

\textbf{Several independent variable definition:}

Body mass index is weight in kilograms divided by the square of patient height in meters, measured by nurse while patient arrived the day before surgery. Admission prior to surgery is a period between admission and day of operation, its grouped according to previous study\textsuperscript{17} that preoperative admission 4-7 days has OR adjusted 1.39 (95% CI 0.81-2.37). Duration of surgery is time count from incision to skin close recorded in surgical report. Duration of surgery was grouped according to National Nosocomial Infection Score (NNIS) risk index cut-off. Surgical re-intervention is a re-surgery needed in between 1 week after first surgery. Delay closure is a procedure make sternum open after surgery until patients hemodynamics stable to close the wound.

Sample were calculated from previous study\textsuperscript{18} with power of study were 80% and alpha error was 5% with odds ratio obesity for mediastinitis was 2.6 and assumption prevalence of obesity were 25 %, we calculate a minimum sample is 654 patient. To improve
the power of study patient eligible were included to this study.

Data were analyzed with STATA 9.2 software. Continuous variables were reported as mean and standard deviation. We examined the overall risk factor of mediastinitis. For BMI analysis, first we divided the study population into two groups obesity and non-obesity by ROC analysis. We also make an analysis with obesity categorized according World Health Organization (WHO) obesity classification i.e. normal (BMI < 25 kg/m²), overweight (BMI 25-29.99 kg/m²), and obese BMI (≥30 kg/m²) for any evidence of dose response. Categorical variable were analyzed with univariate analysis with Chi square and or Fisher exact test. All variable were indicated by univariate analysis has possible association with mediastinitis (p<0.25) were entered in the multiple logistic regression analysis. Unconditional logistic regression with backward stepwise selection confounder strategy and Hosmer-Lemeshow goodness of fit test were used to adjust for the potential confounder and determine final model.

Results

Global population

During study method, there were 743 patients with CABG surgery. We excluded 5 patient of which 4 patients with off pump surgery and 1 patient with Kawasaki disease prior to surgery. In between 738 patients, 32 patient death ≤48 hours after surgery. Among 706 eligible subjects included in study analysis, 35 patients developed mediastinitis (incidence rate= 4.96%).

Univariate analysis

Predictors of mediastinitis post CABG surgery in univariate analysis were shown in table 1.

Table 1. Predictors for mediastinitis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Without Mediastinitis % or mean±SD n=671</th>
<th>Mediastinitis % or mean±SD n=35</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>129 (19.22)</td>
<td>8 (2.88)</td>
<td>0.596</td>
</tr>
<tr>
<td>Patient age≥ 60 years</td>
<td>296 (44.11)</td>
<td>22 (62.86)</td>
<td>0.030</td>
</tr>
<tr>
<td>Body mass index</td>
<td>25.6 (3.86)*</td>
<td>27.2 (4.27)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>258 (38.45)</td>
<td>26 (74.29)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Admission prior to surgery ≥3 days</td>
<td>201 (29.96)</td>
<td>10 (28.57)</td>
<td>0.862</td>
</tr>
<tr>
<td>Interna mammary artery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without</td>
<td>39 (5.81)</td>
<td>3 (8.57)</td>
<td>0.653</td>
</tr>
<tr>
<td>Single</td>
<td>624 (93.00)</td>
<td>32 (91.43)</td>
<td></td>
</tr>
<tr>
<td>Double</td>
<td>8 (1.19)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Duration of surgery ≥5 hours</td>
<td>185 (27.57)</td>
<td>20 (57.14)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bypass time</td>
<td>281 (41.88)</td>
<td>18 (51.43)</td>
<td>0.265</td>
</tr>
<tr>
<td>Aortic cross clamp time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥90 minutes</td>
<td>338 (50.37)</td>
<td>15 (42.88)</td>
<td>0.386</td>
</tr>
<tr>
<td>Surgical re-intervention</td>
<td>30 (4.47)</td>
<td>4 (11.43)</td>
<td>0.061</td>
</tr>
<tr>
<td>Delay sternal closure</td>
<td>16 (2.38)</td>
<td>3 (8.57)</td>
<td>0.026</td>
</tr>
<tr>
<td>Ventilatory day ≥3 days</td>
<td>226 (33.68)</td>
<td>19 (54.29)</td>
<td>0.013</td>
</tr>
</tbody>
</table>

*mean(SD)
From this univariate analysis, there are six variables associated with mediastinitis post CABG (p<0.05). They are include age ≥ 60 years, BMI, diabetes mellitus, duration of surgery ≥ 5 hours, delay sternal closure, ventilatory day ≥3 days. Avoiding the loss of important variable, beside these six variables, surgical re-intervention also included in multivariate logistic regression since p<0.25.

**Utility of BMI to Predict Mediastinitis Post CABG**

The univariate analysis obesity definition based on ROC (obese is BMI ≥26.5 kg/m²) has crude odds ratio 3.31 (95% CI 1.64-6.69). Obesity as an independent variable for mediastinitis has odds ratio 3.34 (95% CI 1.61-6.97) when adjusted for age, diabetes mellitus, duration of surgery, and surgical re-intervention. Analysis based on WHO BMI-obesity classification analysis has incremental adjusted odds ratio of 3.23 for overweight category rose to 4.03 for obese. We tested for the significance of the dose response trend by replacing stratified BMI with the BMI as a continuous variable. BMI entered as a continuous variable was statistically significant (p value <0.001). No effect modification was seen by age, diabetes mellitus, duration of surgery and surgical re-intervention (table 2).

**Multivariate Analysis**

The ROC curve for BMI in predicting mediastinitis post-CABG. The AUC for BMI was 0.67 (95% CI 0.63-0.70). When the BMI cut-off value was set at 26.50 kg/m², the sensitivity and specificity 0.63 and 0.66 respectively. The comparison if cut-off set at 30.00 kg/m² has the sensitivity 0.23 and specificity 0.91.

**Table 2. BMI as an independent risk factor by multiple logistic regression analysis.**

<table>
<thead>
<tr>
<th>Cut-off definition</th>
<th>N</th>
<th>Case of mediastinitis</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR, (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥26.5 kg/m²</td>
<td>227</td>
<td>22 (8.83)</td>
<td>3.31 (1.64-6.69)</td>
<td>3.34 (1.61-6.97)</td>
</tr>
<tr>
<td>WHO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 25 kg/m² (normal)</td>
<td>366</td>
<td>9 (2.46)</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>25-29.99 kg/m² (overweight)</td>
<td>270</td>
<td>18 (6.67)</td>
<td>2.83 (1.25-6.41)</td>
<td>3.23 (1.38-7.56)</td>
</tr>
<tr>
<td>≥30 kg/m² (obese)</td>
<td>70</td>
<td>8 (11.43)</td>
<td>5.12 (1.90-13.77)</td>
<td>(1.41-11.45)</td>
</tr>
</tbody>
</table>

The mean BMI of all population is 50.7 with 8.14 kg/m² standard deviation. Figure 1 shows the area under ROC curve for BMI in predicting mediastinitis post-CABG. The AUC for BMI was 0.67 (95% CI 0.63-0.70). When the BMI cut-off value was set at 26.50 kg/m², the sensitivity and specificity 0.63 and 0.66 respectively. The comparison if cut-off set at 30.00 kg/m² has the sensitivity 0.23 and specificity 0.91.

**Figure 1. ROC Curve Analysis for the ability of BMI as a risk factor of mediastinitis.**
Discussion

Obesity is well-known as a risk factor for developing metabolic syndrome including cardiovascular disorders.\(^\text{20}\) Surgeons know obesity will affect wound healing by inducing physiological, cellular, molecular, and chemical changes mechanism.\(^\text{5}\) Obese (BMI > 30 kg/m\(^2\)) has an effect on the outcome after CABG surgery, as mentioned in several studies and still conflicting.\(^\text{21,22}\)

Obese with BMI cut-off > 30 kg/m\(^2\) as an independent factor for mediastinitis post CABG mentioned by Oliveira SA et al (2011) has an adjusted OR 2.60 (95% CI 1.11-6.68).\(^\text{9}\) Milano et al (1996) Italia use same definition found in multivariate logistic regression with p value <0.001. Study from Parisian Group (1996) which in Paris found the same result with an adjusted OR 2.67 (95% CI 1.27-6.00).

In this population, among elective CABG surgery patients of referral hospital in Jakarta, the mean of BMI in mediastinitis group is significantly higher than non mediastinitis group. Obesity is an independent and dose-related risk factor for mediastinitis after we controlled for other important risk factors such as age, diabetes mellitus, duration of surgery and re-intervention surgical. The elevated risk starts from overweight with three times risk than a normal BMI. The risk higher in patients with obese BMI status. This finding is different from previous study in New Zealand which the risk for mediastinitis starts from obese patients.\(^\text{23}\)

In addition because of BMI as a continuous variable showed a significant increased risk with one point of BMI, we are confident calling this a dose response effect. Although data from several other studies support that obesity is a risk factor for mediastinitis, this study strength lie on big enough total and consecutive sample, design and its control confounding. This study is one of the first studies assessing obesity as a risk factor for mediastinitis in Indonesian CABG patient population. The previous Asian study done by Wang et al at medical center in Taiwan found no significant difference between mediastinitis and control. Another study commonly hospital with white race use BMI ≥30 kg/m\(^2\) obesity definition.\(^\text{7–9,16,18}\) We were able to control for many of the established risk factors for mediastinitis such as diabetes mellitus, duration of surgery and surgical re-intervention, as well as for potential but unestablished such as age.

A limitation of this historical cohort study is document dependent. We cannot change any unsuitable record in hospital. Another bias information for outcome because of uniformity duration of follow up patient in inpatient even outpatient setting. But this bias is non differential, that mean not change the final result. Another limitation is almost all predispose factor are unmodifiable factor, then a very limited improvement can be done.

The strength of this study is use big enough sample and consecutive sampling. This method allow us to minimize a potential selection bias, because all eligible subject are included in the study. We know that the effect of obesity for the wound healing associated by multiple complication include impairment of cutaneous wound healing, total wound failure and wound dehiscence. Another pathway is poor vascularity of adipose tissue promote ischemic relative in an obese tissue than a normal tissue.\(^\text{5}\)

Conclusion

BMI is a risk factor for mediastinitis post CABG. The optimal cut-off point of BMI as a predictor is 26.5 kg/m\(^2\). Overweight has three times and obese has four times risk for mediastinitis. Improving awareness of obesity prevention is an effective technique to prevent mediastinitis among CABG surgery patients.

Acknowledgment: We thank to Mr. Eka Ginanjar MD, the Headmaster of Pelayanan Jantung Terpadu, Cipto Mangunkusumo Hospital and staffs for its permission on conducting this research.

Conflict of Interest Statement: We declare that we have no conflict of interest.

Ethical Clearance: The study proposal was reviewed and approved by Health Research Ethics Committee, Faculty of Medicine Universitas Indonesia protocol number:18-05-0543.

Source of Funding: Ponisih is an infection control practitioner who took this research for master degree. Her study and research process of its publication were taken from personal funding.
References


Comparative Histology of Human, Rats and Rabbits Liver

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Abstract

This study was accomplished to demonstrate the most obvious differences among the hepatic structure of human, rat and rabbit livers. Total of twelve liver specimens of rat and rabbits which were purchased from local slaughter shops in addition to six specimens of human livers from fresh autopsied body of forensic department were studied. The results revealed that the human liver has a thicker capsular structure comparing with those of rats and rabbits and the lobular, interlobular, biliary system, and hepatic cells architecture are also differing in case of human liver comparing with rabbits or rats.

Keywords: Liver, human, rat, rabbit.

Introduction

Considering the organs and their size, the liver is the largest one in the body comprising about 1%-1.5%, 2%, and 3%-4% of the total body weights of the carnivores, omnivores and herbivores respectively1. As a vital organ, the liver comes at the top ranking where it has a paramount role in digestion such as bile production, chylomicron and lipoproteins production, enzymes and coenzyme generation, detoxification of poisons, metabolism of medicines, hormones production, blood cell and blood components modulation and production2.

A network of epithelial cells makes the whole structural parenchyma of hepatic tissue which are held by a connective tissue besides their boosting with hepatic artery and portal vein. The hepatic functional unit is the lobule and what is called hexagon is about plates arrangement pertaining to hepatocytes and they are separated by central vein radiating intervening sinusoids facing outwards. Besides, there are what called triads pertaining to the vertex of solely hexagon3. The liver is a place of blood formation in mammalian fetal early life and for the separation of hepatic lobules it is obvious that the connective tissue among lobules is less recognized and the sinusoids appear to be continued among them and the central vein arouse from each hepatic lobule while the sinusoids appear traversing among hepatocytes plates4. We’ve accomplished this study to understand the nature of and to compare the structures of human, rat and rabbit livers among each other.

Materials and Method

Total number of twelve liver specimens of rat and rabbit, were brought from local slaughter house. Human liver specimens were collected from fresh autopsied body of forensic department after taken appropriate permission. For this comparative study, the selected specimens were free from liver diseases that were confirmed by the case history of autopsied body.

The specimens removed and preserved immediately in 10 percent phosphate-buffered formalin and passed in a series of ethanol treatments, starting from the 70% to 100% storing solution, then were cleared in xylene, embedded in paraffin, and serially sectioned at 6 μm with a rotary microtome. The sections were stained with Hematoxylin-Eosin for general morphology, Lillis Alchrome stain identifying for connective tissue and PAS for identifying carbohydrates according to the protocol of 5. Sections were observed with an Olympus microscope (Leica Galen III) and were photographed with a digital camera (Leica with Dinocapture 2) mounted to a microscope.

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Results and Discussion

The results of this study has disambiguated that the liver structure of the studied samples consists of large lobular structure enclosed by an external capsule of mesothelium nature (Fig. 1). The capsule appeared composed of irregular connective tissue consisting from fibroblasts as seen with Lillie alochrome stains (Fig 2). This result comes in contrast with⁶ who mentioned that the capsule is built up of dense regular connective tissue fibers but comes in line with what was mentioned by⁷. It is obvious from (Fig. 1) that the human liver has a capsule of thicker nature comparing to those of rats and rabbits and also the interlobular septa are thicker in addition to the supporting reticular fibers that were seen in parenchymal structure. These findings come in harmony with those of⁶. It is also obvious that for rats and rabbits the lobules appear hexagonal with no distinct borders among them in contrast to those of human whom were frankly separated by septa which are emerging from the peripheral capsule (Fig. 3,4,5 and 6). These overlapped hepatic cells make a conformational radiating architecture besides the marginal or peripheral central veins who finally pour into hepatic vein. This observation is also supported by⁸. The portal zone is built up of four structures: a branch of the hepatic artery, a branch of the hepatic portal vein, and a bile duct, in addition to lymphatic vessels. The hepatic vein lumen was wide and lined by simple squamous epithelium in the tunica intima and supported by the tunica media that consist from smooth muscle fiber. The hepatic artery was also lined by simple squamous epithelium; the smooth muscles of the tunica media were separated by the tunica intima by internal elastic laminar (Fig. 2). These noticed findings were in line with those of⁹. Cuboidal cells line the bile duct. Kupffer cells and hepatocytes surround the central vein. Human hepatic cells appear possessing round, large and centrally placed nucleus with a clear dark nucleolus and usually binucleate (Fig. 2). These observations were also mentioned by¹⁰,¹¹. Between the hepatocyte plates are liver sinusoids, which are enlarged capillaries through which blood from the hepatic portal vein and hepatic artery enters via the portal triads, then drains to the central vein. These sinusoids were lined by discontinuous endothelium and macrophages were seen at the sub-sinusoidal space. These findings are also reported by¹²,¹³.

![Fig. (1) Cross section of human Liver showed the: Central vein (A), Lobule (B), Septa (C), Hepatocytes (Yellow star), portal area (black cycle) that consists of (portal vein, hepatic artery and bile duct), endothelial cells (D). H & E X100 and X 400](image-url)
Fig. (2) Cross section of human Liver showed the: Space of Disse (A), Portal vein (B), Hepatic artery (C), Bile duct (D), Endothelium (E), Hepatocytes (F) and Central vein (Brown star)
PAS X100 (a) and Lillis Alchrome stain X 400 (b).

Fig. (3) Cross section of Rat Liver showed the: Capsule (A), Space of Disse (B), Central vein (C), Portal vein(Yellow star), (B), Hepatic artery (D), Bile duct (E), Hepatocytes (F) and Kupffer cell (G)
H & E X 40 (a), X 100 (b) and X 400 (c).
Fig. (4) Cross section of Rat Liver showed: Hepatocytes (A), Basement membrane (B), Connective tissue (C) PAS and Lillis Alchrome stain X 400.

Fig. (5) Cross section of Rabbit Liver showed: Central vein (A), Portal area (B), Hepatocytes (C), Endothelium (D), RBC (E), Space of Disse (F), Bile duct (G), Portal vein (H) and Hepatic artery (I) H & E X 100 (a), X 400 (b) & (c).
Conflict of Interest: This research is a personal non-profit work and there is no conflict of interest.

Source of Funding: None.

Ethical Clearance: Ethical clearance was obtained from the Faculty Scientific Committee (Department of Anatomy, Histology & Embryology, College of Veterinary Medicine, Al Muthanna University, Iraq) to study comparative histology of human, rats and rabbits’ liver.

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Vital Signs Monitor

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Abstract

Vital sign monitor is used to scan the complete parameters of a person in an ambulance, ICU ward or at home(portable). Our project is a working model which incorporates sensors to measure all these parameters like body temperature, blood pressure, heart rate and the partial pressure of oxygen-SPO2. The SPO2 circuit can also function as a saline monitoring circuit which gives alarm when the saline bottle becomes empty. The IR sensor emits infra red rays which when absorbed by the tissues gives the oxygen saturation of the arterial blood. Both audible and visual alarms are produced when there is any sort of errors. The main components of our project are the sensors, signal conditioning board and the microcontroller. The microcontroller used is PIC 16F877A.

Keywords: Complete parameters; Vital sign monitor; Sensors; PIC microcontroller.

Introduction

The aim of this paper is to develop a non invasive vital signs monitor with a greater accuracy. Not only to adults but this technique can also be used for pediatric and neonatal patients by changing the probes of SPO2. Here three sensors are used namely LM 35, IRC 502 and IR sensor. A signal conditioning circuit is used which converts analog signals into digital signals.¹²

A timer attached to the circuit makes it specific for measuring the parameters at regular intervals. Cellular connection can be given to transfer data from the device to the system or Smartphone. Buzzer beeps when the parameters values goes either too high or too low.³⁴ We employ two transformers in this circuit. The use of a single transformer is enough for the circuit but to get more exact result we applied an extra transformer. A clock circuit is present which is said as the ‘heart of the microcontroller’. Fixed regulators are attached to maintain constant output.

Methodology

Sensors are used to receive information from the body. The output is displayed in the LCD display of 16 inch. The microcontroller used here is PIC 16F877A.

Reasons for using PIC 16F877A:

Core Features:

- High performance
- Only 35 single word instructions to learn
- Power-on reset
- Power–up timer
- Wide operating voltage(2 to 5.5 v)
- Low power consumption
- Cheap in cost.

Temperature sensor- The LM35 series are precision integrated circuit LM35 temperature sensors whose output voltage is proportional to the Celsius temperature. Thus the LM35 sensors has an advantage over the linear temperature sensors, as the user is not required to subtract a large constant voltage from its output to obtain convenient centigrade scaling. It does not require any external calibration or trimming to provide typical
Heart beat sensor-IRC502 is used as a heart beat sensor. The same circuits used to detect the pressure.

IR sensor-In basic the I.R waves has the highest wavelength than the existing VIBGYOR color spectrum. The I.R can be generated by applying electric current to GALLIUM ARSENIDE semiconductor material.

**Results**

Theoretically the device is proved; practically it is yet to be designed. Thus, the procedure has to be followed and the device is yet to be constructed.

**Discussion & Conclusion**

All the components required for the construction of vital signs monitor has been purchased. The necessary papers and articles required for the development of the project has been done during the first phase of the project.

**Ethical Clearance**- No ethical clearance was necessary for this research work

**Source of Funding**- Self Funded Project

**Conflict of Interest** - Nil

**References**


3D Printed Limb Rotation

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Abstract

Amputees regularly experience the ill effects of different physical and mental troubles because of their failure to utilize their furthest points for their normal works. To help those amputees in getting an utilitarian substitution 3D printed hand at a doable cost, a model prosthetic arm was made using jump movement sensor, a 3D printable hand model, and Arduino. To stay away from increasingly costly, substantial weight and baffling control strategies which incorporates myoelectric prosthetics, a jump movement sensor which records the hand motions enables the Arduino to take after a similar signal that he wishes the hand to perform. The bounce development sends this information to the Arduino, which controls the servo motors to start each finger freely. The clear improvement and lightweight materials, and what’s more the usage of contraptions, for instance, bounce development, engages amputees to get to new prosthetics effectively.

Keywords: Amputees, myoelectric, Arduino, jump movement.

Introduction

Amputees frequently experience the ill effects of different physical and mental troubles because of their failure to utilize their furthest points for their standard works. To bolster those amputees in obtaining a practical substitution 3D printed hand at an achievable cost, a model prosthetic arm was made using jump movement sensor, a 3D printable hand model, and Arduino. To keep away from increasingly costly, substantially weight and baffling control strategies this incorporates myoelectric prosthetics. A jump movement gadget which records the hand motions enables the Arduino to look like a similar signal that he wishes the hand to perform. The jump movement sends this data to the Arduino, which controls the servo engines to initiate each finger independently.

3D printing and the additional substance delivering is the system that makes by the solid things from the three-dimensional automated life. The methodology of inquiry is cultivated by using included substance 3D printed creation. The additional substance methodology of dissent is made by the dynamic layers of setting down materials is made. These layers are pitifully cut level cross portion of the given inescapable protest. Now multi day’s 3D printer we are utilizing each and everything on the planet. In that printer, there is greater headway that is building houses, military purposes, making rocket parts and so forth. There are distinctive kinds of printers and materials. Typically the idea is replicated from the ink printer. A similar idea is utilizing in the 3D printer however in this we are utilizing numerous materials like polymers. This printer can deliver warmth and dissolve the polymer and it makes the plan as what we are given in the product.

Jump Motion, Inc. is partner degree yankee organization that makes and markets a segment gadget that bolsters hand and finger movements as information, comparable to a mouse, anyway needs no hand contact or contacting. In 2016, the corporate released new code intended for hand interest in computer game.

The Leap Motion controller might be a modest USB PC fringe that is intended to be set on a physical work area, confronting upward. It can even be mounted onto a computer game recipient. exploitation 2 monochromatic
IR cameras and 3 infrared LEDs, the gadget watches a generally subfigure space, to a separation of with respect to one meter. The LEDs produce design less IR lightweight and furthermore the cameras create about two hundred casings for each second of reflected learning. this can be then sent through a USB link to the host pc, wherever it’s broke down by the Leap Motion code exploitation “complex maths” amid an implies that has not been uncovered by the corporate, in a way blending 3D position learning by examination the second casings produced by the 2 cameras. amid a recent report, the general normal exactness of the controller was appeared to be zero.7 millimeters.

The littler perception space and better goals of the gadget separates the stock from the Kinect, that is a great deal of suitable for entire body interest amid a house the elements of a receiving area. amid an exhibit to CNET, the controller was appeared to perform errands like exploring a web website, exploitation squeeze to-zoom motions on maps, high-exactness drawing, and controlling propelled 3D learning representations.

Utilizing Fitt’s Law to Model Arm Motion Tracked in 3D by a Leap Motion Controller for Virtual Reality Upper Arm Stroke Rehabilitation.

Material and Method

The different pieces of the hand unit structured one by one and unit 3D composed with Early and concentrated treatment will improve higher arm and hand commonsense for stroke survivors. PC amusement frameworks that use condition of-workmanship characteristic PC program trailing sensors and adaptative client recognizable proof PC code can possibly enhance old physiatrics and associate patients to support accommodating sum and nature of restoration. amid this paper, we offer a diagram of the issue space related blessing results from an underlying test with solid clients. The potential for Fitts’ law to display client movement viably in reach and bit undertakings at interims 3D virtual conditions is examined. Results show that Fitts’ law is likewise viable in spite of the fact that we tend to recommend that it’d best be utilized as a piece of an extra muddled model of client movement. The spherical motion based on the converse kinematics for a Delta robot Authour:Y. Pitisetheraphab*, M.Siangworasi Year:2015

The robot arms used in exchange square measure named 2 classes just as the sequential machine and furthermore the parallel machine. Contrasted and the sequential robots, parallel robots have endowments in high exactitude, high solidness, high burden, fast and low idleness. This work arranged and implemented a component to perform circular movement with simply further change of a Delta-based machine and furthermore the exploratory outcomes demonstrated that this style is reasonable and stable for utilization. steady with the quantitative examination, the blunders square measure among numerous millimeters.

Structure and Construction of System to Control the Movement of The Robot Arm

The objective of this endeavor was to watch out for the organizing and improvement of a system to manage the advancement of the machine arm from remotely by methods for remotely glove misuse flex sensors and thus the obstruction. The arranged and made of the errand made out of five rule parts : 1) The identifier includes a heading unit with Flex Sensors and an edge Sensors (variable resistor), 2) the banner conditioner half fuses opposition circuit and voltage differential electronic rigging circuit, 3) the banner method half maltreatment microcontroller Arduino Mega 2560 with C-tongue program, 4) the banner transmitter and beneficiary half maltreatment Xbee plan two module (Zigbee Wireless Standard) and 5) robot arms sketched out and improvement with Cartia program and 3D printer. The results of conscious testing of the endeavor showed that this technique will organization the advancement of the fingers, wrist, elbow and shoulders obliging with the goals of the endeavor.

Natural and Adaptive Robotic Arm Manipulation utilizing the Leap Motion Controller
plastic new methodology that certifications to manage the prerequisites of matured people. an indispensable objective of AAL is to add to the standard of lifetime of the matured related unfit people and encourage them to deal with an independent modus vivendi.

The presentation of AI and innovation upheld situations can assume an expansive job in allowing matured and physically impeded people to remain carrying on with a self-decided, independent life in their familiar environment. amid this paper, the usage of a totally interesting natural and accommodative control subject is anticipated, by building up a human-machine correspondence interface between the Leap Motion controller and accordingly the 6-DOF Jaco mechanical arm. partner rule is created to allow partner ideal mapping between the client hand development, caterpillar-followed by the Leap Motion controller, and consequently the Jaco arm. The framework should give an extra common human-PC cooperation and a smooth control of the mechanical arm, by ceaselessly adjusting to the client hand tremor or shake. The execution would extraordinarily upgrade the way of life, especially for people with higher appendage issues, and would bolster them in performing expressions some of the fundamental Activities of Daily Living “ADLs”. The uses of this human-robot communication are referenced in connection with close supported Living, wherever some utilization case consequences are presented.

**Result and Discussion**

By and large, robots ar modified to perform explicit errands that people can’t. to broaden the work of robots wherever conditions aren’t bound like chimney battling or salvage activities, robots might be made that adhere to the guidance of human administrator and play out the assignment. amid this methodology determinations ar taken per the working conditions by the administrator and along these lines the errand is performed by the robots. Consequently, we can utilize these robots to perform thosetasks that will be destructive for people. This paper depicts concerning the signal administration golem which might be constrained by your customary hand motion. It comprises of mainly 2 components, one is transmitter half and another is recipient half. The transmitter can transmit the flag per the situation of estimating framework and your hand motion and in this way the recipient can get the flag and make the golem move a few way. Here, the program is implied by misuse Arduino IDE.

Hand Gestures Remote Controlled Robotic Arm, ShamsheerVerma

In this paper writer has clarified the occasion of a mechanical arm, prepared by him, that is worked & controlled remotely with the help of hand signals. It’s a class – five golem (Numerical administration Robot). The complete automated get together is made into a couple of parts viz a transmitter get together put on the gloves containing APC-220 Module, Arduino Board, Gyroscope, estimating framework and a collector (Robotic Arm) involving APC-220 Module, Arduino Board, Servo Motors and arms mounted on roundabout spinning base assembling.

**Conclusion**

In this paper writer has clarified the occasion of a mechanical arm, prepared by him, that is worked & controlled remotely with the help of hand signals. It’s a class – five golem (Numerical administration Robot). The complete automated get together is made into a couple of parts viz a transmitter get together put on the gloves containing APC-220 Module, Arduino Board, Gyroscope, estimating framework and a collector (Robotic Arm) involving APC-220 Module, Arduino Board, Servo Motors and arms mounted on roundabout spinning base assembling.

**Ethical Clearance**- No ethical clearance was necessary for this research work

**Source of Funding**- Self Funded Project

**Conflict of Interest** – Nil

**References**


Hartmann’s Solution Heart Lung Machine

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Abstract

The pump console used at our institute is a HL20, AB, Lund, Sweden), unit with four single modular roller pumps or a combination of three roller pumps with a centrifugal pump. The unit comes with a 24-volt inbuilt battery pack in the base of the console. The batteries consist of 230-A/hour, 12-volt, gel-filled batteries. The main input voltage to the console control module is constantly monitored. Should the line voltage fall to less than 85% of the nominal voltage (220 volts), the unit automatically switches to battery. This battery system will run the complete system, all pumps, supervisory modules, monitoring, and data recording in the event of power failure. The total length of battery operation time reported by the manufactures of a complete system, one arterial at per minute (LPM) (156 rpm), three ancillary pumps (50 rpm), pump display and system monitoring is approximately 1.5 hours. Battery operation time depends on the conditions of the battery and the load powered by the batteries.

Keywords - heart lung machine, centrifugal pump

Introduction

Fully discharged pump batteries were charged overnight before each test for a minimum of 12 hours. Closed system circuits were assembled for each of the trials. The system comprised a oxygenator Hartmann’s solution. The console has a monitoring unit that records data to a memory card. This card can be read on a standard computer with appropriate software. The run time of the pump was recorded automatically, eliminating the need for the manual observations. Before each test, the memory card was initialized and the test noted on the memory card. Manual observation was necessary only during battery voltage drop monitoring versus time.

Material and Method

Test 1

Using the arterial pump, only the prime was circulated at 200 rpm at a pressure of 180 mmHg using boot. The arterial outlet pressure was achieved by partially clamping the arterial outlet using a gate clamp. Voltage was recorded ever 15 minutes until the pump stopped. Battery run time was noted.

Test 2

The prime was circulated at different speeds (100 rpm and 200 rpm) using the arterial pump. The arterial outlet pressure was 180 mmHg. Battery run time was recorded.

Test 3

Using the roller pump boot the prime was circulated at 156 rpm (4 LPM), using an arterial pump and then using 1, 2, and then 3 additional pumps at 50 rpm. Battery life was recorded. This was repeated with an arterial outlet pressure of 180 mmHg.

Test 4

Test 3 was repeated with an arterial outlet pressure of 180 mmHg and repeated with a roller pump with a 3/8-inch PVC boot and an arterial outlet pressure of 180 mmHg.
Using a different pump console with an older circuit, one that was 15 months old, the prime was circulated at 156 rpm (4 LPM) using the arterial pump.

A comparison was made between different pump types. Centrifugal pump was incorporated into the circuit. The prime was circulated at a speed of 4 LPM and a pressure of 180 mmHg. The battery run time was recorded.

It should be noted that the monitoring and data collection system on the system cannot be shut down to conserve battery life and will be draining current for the duration of the procedure irrespective of the number of pumps in use. Each test was run in triplicate and all data are presented as mean±2.

**Results**

Illustrates battery run time versus voltage drop of a roller pump at 200 rpm using no additional pumps with arterial outlet pressure of 180 mmHg. The run time of the battery was 308 minutes. is a comparison of the run time in minutes of a roller pump with silastic boot at 100 and 200 rpm, pressurized to 180 mmHg using no additional pumps. shows the battery run time of a roller pump at 156 rpm (4 LPM) using additional pumps in a pressurized and no pressurized circuit.

Battery run time versus voltage drop of a roller pump at 200 rpm using no additional pumps with arterial outlet pressure of 180 mmHg. The run time of the battery was 308 minutes. Comparison of the run time in minutes of a roller pump with silastic boot at 100 and 200 rpm, pressurized to 180 mmHg using no additional pumps. Battery run time of a roller pump at 156 rpm (4 LPM) using additional pumps in a pressurized and no pressurized circuit.a roller pump with PVC boot using 0, 1, 2, and 3 additional pumps also pressurized to 180 mmHg. The run times of a new and old battery pack powering a roller pump using 3 additional pumps and pressurized to 180 mmHg,Comparison of the run time of a battery powering a centrifugal pump and a roller pump at a speed of 156 rpm, pressurized to 180 mmHg and using no additional pumps.

**Discussion**

Adequate knowledge of the battery life during electrical failure in the heart lung pump consoles by the perfusionists is necessary to conserve battery life. The consequence of power failure can be catastrophic. In a recent study to identify incidents occurring in centres performing CPB showed that during a 2-year period 267 incidents of 4882 required hand cranking of the machine or the machine that had power interrupted (2). In this study, we demonstrate a variety of factors that affect power consumption of batteries of a heart lung pump console during simulated electrical failure.

As stated by the manufacture’s guidelines and as seen, the voltage of a battery during electrical failure drops relatively slowly at the beginning of use. As the battery becomes exhausted, the voltage drops more rapidly. When the voltage has dropped to 22 volts, there is only enough for a few more minutes of operation. The system warns the operator of an impending halt by sounding a double bleep that cannot be silenced, and the battery operation lamp on the console flashes. When the battery drops to 19.2 volts, operation of the pump motor becomes unpredictable and the system halts. The life of a battery powering a roller pump using no additional pumps at 200 rpm was 308 minutes.

The effects of the main arterial pump speed on battery life were examined. From , it can be seen by doubling the pump speed from 100 rpm to 200 rpm, battery life is reduced by 20%. It would indicate that by using larger tubing in the roller raceway would help to reduce the revolution thus reducing battery drain.

The difference in the life of a battery, powering a roller pump in a pressurized circuit and no pressurized using additional pumps was examined. shows the life of a battery in minutes using a pump at 156 rpm (4 LPM), no pressurized and then pressurized, using 1, 2, and 3 additional pumps at 50 rpm. The average difference in battery life between the pressurized and the nonpressurized circuit was 10%.Taking account of the cumulative effects of the number of pumps in service the results indicate that the average decrease in battery life for each additional pump used was 14%.

In test 4, we examined the effects of increased boot stiffness.Increased boot stiffness decreases battery life. At 156 rpm (4 LPM), the average difference in battery life between the circuit with a silastic boot and PVC boot boot...
was 20%.

The effects of battery age on battery run times can be seen in . We examined the effects of age by comparing the run times of a pump utilizing a new and old pump console. The run times of both batteries in the consoles were similar. Powering a roller pump at 156 rpm using 3 additional pumps battery life of the new and old batteries were 167 minutes and 179 minutes, respectively. The life of properly maintained batteries is not altered noticeably with age. In our unit, batteries are changed every 2 years as part of the routine maintenance of the heart—lung machine.

The results in also show that the use of a centrifugal is less draining on battery power than a roller pump. The life of a battery powering a roller pump and centrifugal pump was 354 minutes and 430 minutes, respectively a difference of 18%. On the basis of results, one is encouraged to take account of the factors affecting battery life during electrical failure. Knowledge of these results will alert the perfusionist to necessary termination of systems to conserve battery life.

**Conclusion**

This study was conducted as an investigation into heart—lung machine battery life under a variety of conditions. The result of the study demonstrates that the run time of a battery pack may far exceed manufactures guidelines. The manufacture state that the total length of battery operation of a complete system (one arterial pump at 156 rpm, 3 sucker pumps [50 rpm], pump displays and monitoring systems) is approximately 90 minutes. Our study demonstrates that the battery life actually lasts longer, i.e., 179 minutes for the same system. These results show that the run time of a battery back-up pack is affected by the number of pumps in use, pressure load on the circuit, boot material, and type of pumped. These factors affect the longevity and performance of the battery. This information could be of value to the individual who encounters catastrophic institutional power failure or who is transporting a patient on battery power. Perhaps, perfusion teams can use the methods mentioned as a model to test and appreciate the limitations of their own battery power systems.

**Ethical Clearance**- No ethical clearance was necessary for this research work

**Source of Funding**- Self funded Project

**Conflict of Interest** - Nil

**References**

Non Invasive Technique for Measuring Blood Glucose based on IOT

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Abstract

Glucose monitoring devices acts as a good frontier in diabetes research. Many efforts have been taken in the way to develop various methods for non-invasive glucose monitoring devices, which can ease the life of people suffering from diabetes. The diabetes regulation method must be done in order to maintain proper glucose level in blood. As urine testing methods are outdated now, so to make the process easy, accurate, reliable and effective method is the use of IR technology. Due to lack of time people prefer self- monitoring system and it is also cost effective. Hence, a non-invasive method to get the value of glucose level. To provide a comfortable treatment a non-invasive device is made which measure the blood glucose level using the IR technology. Hence, by using non-invasive technique it is very easy and flexible to use and obtain the expected output without consuming much time, we can get the results within few seconds and the result is displayed in the LCD display.

Keywords: Diabetes, non-invasive, glucose level, IR technology.

Introduction

Diabetes is a kind of disease which is rapidly increasing spreading within every individual as per estimation in India 62 million people are suffering. Blood sugar concentration or blood sugar level can be defined as the amount of glucose present in the blood. Normally, in mammals the body maintains the level of glucose between the range of 3.6 and 5.8 mM(mol/L). Glucose is the main energy source in the cells, lipids being a compact storage of energy. It is transported from the intestines or liver to the cells of the body with the help of bloodstream, and is absorbed by body cells with the intervention of hormone insulin which is being produced by the body. The normal blood glucose level in human is about4mM. The approximate amount of glucose in the body and the fluids is very small. The mechanism of control in the human works on very small quantities of glucose, so the use of monitoring systems came to use for measuring the parameters.

In a healthy adult, male of 75 kg have a blood volume of 5 litres, a blood sugar level corresponds to about 5g of sugar in the blood and it is approximately 45g in the total body water. By using this non-invasive method, the level of glucose can be easily detected with the help of IR technology and the result is shared over a range of network which eases the life of the patient.

Materials and Method

The materials required are

• Arduino board,
• LCD Display,
• IR Sensor,
• AC to DC converter,
• Transformer.

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IOT technique. In this non-invasive technique, a finger is placed on the IR sensor, there a external light source is used to derive infrared from the spectrum using IR sensor. The infrared rays are passed into the finger and then into the blood vessels. The amount of glucose present in the blood absorbs the infrared rays at a particular wavelength, and the level of glucose in the blood is detected and the value is transported to Arduino board and the signal is passed from analog to digital converter which is then further displayed in the LCD display. The result obtained is shred over a wide range of network using a technique known as IOT.

Result and Discussion

A particular patient is taken into account who is having abnormalities regarding glucose level present in the blood. He is asked to place a finger on the IR sensor, the IR sensor by using its wavelength and absorption technique it detects any slight abnormalities present in his blood. The detected value is shown on the display monitor and to reduce mobility this result can be sent over a wide range of network using IOT. This device is a personalised one and it can be used over and over again.

Diabetes is a kind of disease which is rapidly increasing spreading within every individual as per estimation in India 62 million people are suffering. Thus to provide a comfortable treatment a non-invasive device is made which measure the blood glucose level using the IR technology.

In the existing method the patient have to go to various places like laboratory, hospitals, etc. and have to wait for several hours to see the result. It either takes blood from the arms or collects urine sample and then have to carry out the process to obtain the result and it’s a time consuming process. To provide a comfortable treatment a non-invasive device is made which measure the blood glucose level using the IR technology. Hence,
by using non-invasive technique it is very easy and flexible to use and obtain the expected output without consuming much time, we can get the results within few seconds and the result is displayed in the LCD display.

**Conclusion**

This method is non invasive and time consuming, mainly used for the regular monitoring for the diabetes patients. At the same time the results are easily monitored and stored using the Internet of Things (IOT).

Thus to provide a comfortable treatment a non-invasive device is made which measure the blood glucose level using the IR technology. Hence, by using non-invasive technique it is very easy and flexible to use and obtain the expected output without consuming much time, we can get the results within few seconds and the result is displayed in the LCD display.

**Ethical Clearance**- No ethical clearance was necessary for this research work

**Source of Funding**- Self Funded Project

**Conflict of Interest** - Nil

References


Patient Monitoring System in Hospital

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Abstract

The paper contains various advancement that the times have seen in the field of patient checking framework throughout the years. Likewise the execution of the framework that has been made by utilizing brilliant bio-sensors that identifies and records the physiological attributes of human and interfacing information to a PC with the utilization of remote conventions that alerts the specialist about wellbeing state of the patient on normal interims after evaluation. The summing up of the advancements will improve the nature of human services expanding its productivity, making it cost proficient and therapeutic blunders.

Keywords Smart bio- sensors, wireless product.

Introduction

The target of patient checking gadget is to have a quantitative appraisal of the imperative physiological factors of the patients amid basic times of their natural capacities¹. Quiet checking frameworks are utilized for estimating consistently or at standard interims, consequently the estimations of the patient’s vital physiological parameters⁴. The principle target of patient observing framework is to institutionalize everything from medicinal wording to systems administration conventions with the goal that restorative records can be put away electronically and in a split second sent to the doctor. In a patient checking framework appropriate parameters, which have a high data content, is an imperative issue. Electrocardiogram (ECG), beat rate, beat oximetry, circulatory strain (aberrant blood vessel pulse, direct blood vessel blood weight), body temperature and respiratory rate. Persistent screens are most essential analytic gadgets in the basic consideration unit of medical clinics, giving proceeds with showcase and translation of the patient’s indispensable capacities². The quick development of hardware and data innovation is bringing about increasingly ground-breaking bedside persistent screens fit for complex bio-signals handling and understanding and generally outfitted with some particular correspondence interface⁵.

Materials and Method

HARDWARE SETUP

The hardware setup plays a vital role in the designing process of this project. The following are the building blocks of the vehicle. They are:

- ARUDINO Microcontroller.
- TEMPERATURE Sensor.
- PH Sensor.
- 16x2 LCD Display.
- VIBRATION Sensor.
- LASER.
- PHOTODIODE.

Data Acquisition is performed by multiple wearable sensors that measure physiological biomarkers, such as ECG, skin temperature, respiratory rate, EMG muscle activity, and gait (posture). The sensors connect to the network though an intermediate data aggregator or concentrator, which is typically a smart phone located in the vicinity of the patient.

The Data Transmission components of the system are responsible for conveying recordings of the patient from the patient’s house (or any remote location) to the data center of the Healthcare Organization (HCO) with
assured security and privacy, ideally in near real-time

The system is designed for long term storage of patient’s biomedical information as well assisting health professionals with diagnostic information. Cloud based medical data storage and the upfront challenges have been extensively addressed in the literature. Analytics that use the sensor data along with e-Health records that are becoming prevalent can help with diagnoses and prognoses for a number of health conditions and diseases. Additionally, Visualization is a key requirement for any such system because it is impractical to ask physicians to pore over the voluminous data or analyses from wearable sensors. Visualization methods that make the data and analyses accessible to them in a readily digestible format are essential if the wearable sensors are to impact clinical practice. In the following sections, we consider the key elements of the overall system illustrated in Fig. 1 and highlight the opportunities and challenges for each in integrating remote health monitoring into clinical practice.

**ARDUINO Microcontroller:**

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world. Arduino boards may be purchased preassembled, or as do-it-yourself kits; at the same time, the hardware design information is available for those who would like to assemble an Arduino from scratch.

**Temperature Sensor**

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature.

**Vibration Sensor**

A piezoelectric sensor or pressure sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical charge. Piezo buzzer exploits the piezoelectric property of the piezo electric crystal. The piezoelectric effect may be direct piezoelectric effect in which the electric charge develops as a result of the mechanical stress or reverse piezoelectric effect (Converse piezoelectric effect) in which a mechanical force such as pressure develops due to the application of an electric field.

**Result and Discussion**

In this paper, we reviewed the current state and projected future directions for integration of remote health monitoring technologies into the clinical practice of medicine. Wearable sensors, particularly those equipped with IoT intelligence, offer attractive options for enabling observation and recording of data in home and work environments, over much longer durations than are currently done at office and laboratory visits. This treasure trove of data, when analyzed and presented to physicians in easy-to-assimilate visualizations has the potential for radically improving healthcare and reducing costs. We highlighted several of the challenges in sensing, analytics, and visualization that need to be addressed before systems can be designed for seamless integration into clinical practice.
Conclusion

This treasure trove of data, when analyzed and presented to physicians in easy-to-assimilate visualizations has the potential for radically improving healthcare and reducing costs. We highlighted several of the challenges in sensing, analytics, and visualization that need to be addressed before systems can be designed for seamless integration into clinical practice.

Ethical Clearance-  No ethical clearance was necessary for this research work

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References


Spinal Braces to Prevent Occupational Back Pain

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Abstract

Back torment is the most widely recognized issues among the working people. Lower back agony is the significant grumbling, expends a high level of work related doctor firms. It has an incredible part in work non- attendance and keeps on being a noteworthy wellbeing trouble among people. Restorative science can't unmistakably recognize between agony brought about by work and because of other conceivable exercises. Word related back torment is experienced by a great many people at some piece of their lives and is exorbitant to both the medicinal services and the business. A noteworthy Non-medicative strategy for aversion of back agony is viewed as great stance upkeep. To help the great stance we are structuring a support which sense the flexion in the spinal ebb and flow particularly in the lumbar area, which alarms the individual and aides in recapturing the stance.

Keywords: lower back agony, lumbar area, great stance, non-medicative.

Introduction

Back agony is the most well-known medicinal issue in the advanced world with the vast majority of individuals having it once in their life time and four out of five working individuals having it consistently. Albeit back agony does not cause lasting inability, it is a noteworthy explanation behind work incapacity, doctors visit and non-appearance. Agony in any district of the back is alluded as Back torment. It is isolated into three kinds dependent on the portion of the spine influenced. They are

i. Neck pain (cervical)
ii. Middle back pain (thoracic)
iii. Lower back pain (lumbar)
iv. Coccydynia (tailbone or sacral torment)

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The most well-known back torment happen in the lumbar district, as it bolsters the greater part of the body weight. In light of the span of the torment goes on for, back torment is arranged into

i. acute (lasts up to 12 weeks)
ii. sub acute (usually alluded to second 50% of the intense)
iii. chronic (persists past 12 weeks)

The torment might be portrayed as adult hurt, shooting or puncturing torment, a copying sensation or a deadness. The torment may emanate into arms and legs just as into the hands and feet.

Human spine is made out of complex structure of muscles, tendons, ligaments and bones. The fragments of the spine or vertebrae are padded with the ligament or stun retaining plates that padded the bones and aides in bowing the spine and held all together. Issues with any of these spinal parts can cause back agony.

Strain (stressed muscle, stressed tendons, muscle fit) is the most widely recognized reason for back torment. Back torment are because of different causes, which incorporates harm in inside organs, veins, mechanical and auto resistant causes, spinal string, nerve roots,
vertebral section and mishaps. Muscles around the spine can cause torment as well, as they are very delicate and even the scariest damage can cause torment. Back agony is likewise due to alluded torment. Alluded torment implies torment happens at the diverse area other from the source.

Stoutness, stationary way of life, smoking, poor stance, absence of maintenance, weight increase and pregnancy are the hazard elements of back torment.

Upper back torment includes torment in the upper area of the spine and the neck i.e., cervical locale which causes every day distress, firmness in the neck and shoulders.

Center back torment influences the spine between the lumbar and cervical zones and is alluded to as thoracic agony. It is the less as often as possible causing back torment.

Lower back torment includes the lumbar area of the spine. It is the most ordinarily causing back agony, as the lumbar area bolsters the heaviness of the body and aids in twisting the spine and pivoting the hip bone. It is generally alluded as Occupational Back agony. Torment in lower back can be a consequence of deformation in the vertebrae or circles or ligaments around the bones. Deformation in these structures is because of mechanical strain or business related exercises or slumping or poor posing. One of the huge reasons for lower back torment is poor posing. Albeit lasting crippling for back torment is exceptionally uncommon, Non-meditative strategies are the most ideal approach to treat back agonies. Consequently, so as to keep the back agony by keeping up great stances, we are structuring a spinal support. These props recognize the adjustment in the spinal ebb and flow utilizing flex sensors in this manner helps in keeping up recovering the stance.

**Methodology**

As, there is no specific strategies for changeless incapacitating the back agony, the primary objective in treating back torment is to accomplish the maximal decrease in torment force as quickly as would be prudent and to assist the patient with coping with remaining patient. For a few, the objective is to keep the torment in sensible dimensions. Not all the conceivable medications work for all conditions or for all people with same conditions. We have to discover which works best for them.

Back agony treatment incorporates medical procedure, meds like NSAID’s, skeletal muscle relaxers, ESI and non meditative techniques like Heat treatment, work out, Massage treatment, Acupuncture, Spinal control, back school etc., These strategies treats back torment. As there is no changeless fix, we are wanting to avert word related back agony by keeping up a decent stance relaxed.

II a. Pic microcontroller:

The pic miniaturized scale is the champion among the most standard and the 16F877A is a fit microcontroller that can do numerous endeavors since it has inadequately tremendous programming memory of 8k words and 368 Bytes of RAM. The 40 DIP pinout make it less requesting to use the peripherals as the limits are spread out over the pins and it has various inward peripherals.

A PIC 16F877A microcontroller is ground-breaking easy to-program CMOS FLASH based 8-bit microcontroller packs PIC designing into a 40-44 stick bundle and upwards great with the PIC16C5X, PIC12CXXX and PIC16C7X gadgets.

**Results**

**Features**

- 256 bytes of EEPROM data memory
- Self programming
- An ICD, 2Comparators
- 8 channels of 10-bit Analogy-to-digital(A/D)converter
- 2 PWM10-bit
- Parallel slave port
- Operating voltage :4.0-5.5volts
- 25mA sink/source perlI/O

These segments make it ideal for more impelled dimension A/D applications in gadgets, car and mechanical apparatuses.

The pic controller here takes the estimation of flexion identified by the flex sensor as the info and gives
a yield to the ringer, LCD and engine.

**Flex sensor:**

A flex sensor is a sensor that estimates the measure of avoidance or bowing. By and large, the sensor is adhered to the surface, and opposition of sensor component is fluctuated by twisting the surface. As the opposition is specifically corresponding to the measure of twist it is utilized as goniometry and frequently called adaptable potentiometer.

Flex sensors are detached resistive gadgets that can be utilized to recognize bowing or flexing. It is a bi-directional flex sensor that diminishes its obstruction in extent to the sum it is bowed in either heading. It very well may be interfaced with the microcontroller unit. The yield from the sensor is simple. The sensor helps in detecting the avoidance or flexion in the spinal arch.

Flex sensor here used to gauge the flexion in the spinal bend

**Signal:**

A ringer or beeper is an electronic sound flagging gadget normally utilized in family unit machines and vehicles and so forth., It is an incorporated structure of electronic transducers, DC control supply. Bell produces predictable single tone sound just by applying D.C voltage. Utilizing a reasonably structured thunderous framework, this sort can be utilized where extensive sound volumes are required. At Future Electronics we stock a large number of the most widely recognized sorts classified by Type, Sound Level, Frequency, Rated Voltage, Dimension and Packaging Type.

Ringer here is utilized to caution the individual, when the flexion achieves the edge esteem which is coded in the controller.

**Discussion**

**Single channel Relay:**

A hand-off utilized here is L293D. It is an electromechanical switch which is initiated by an electric flow. A solitary hand-off board course of action contains driver circuit, control supply circuit and confinement circuit. A transfer is collected with that circuit. The driver circuit contains transistors for exchanging tasks. The transistor is use for exchanging the transfer. A separation circuit keeps invert voltage from the transfer which shields the controller and transistor from harm. The info beat for exchanging the transistor is given from the microcontroller unit. It is utilized for exchanging of a solitary gadget.

**DC Gear Motor (60rpm):**

Rigging engines are an across the board blend of an electric engine and gears or a gearbox. It is a mix of engine with apparatus reducer framework. Apparatus engine used to bring down the engine’s speed while expanding the torque.

An apparatus engine adds mechanical riggings to adjust the speed/torque of the engine for an application. Typically such an expansion is to lessen speed and increment torque. A DC engine without apparatuses is helpful in numerous applications. DC Gear engine here aides in hardening the circles of the supports to recover the stance.

**LCD(liquid precious stone showcase):**

LCD is the development used for shows in scratch pad and other tinier PCs. Like light- discharging diode (LED) and gas-plasma advancements, LCDs permit presentations to be a lot more slender than cathode beam tube (CRT) innovation. Level screen LCD and plasma screens work in an absolutely interesting way. In a plasma screen, each pixel is a little glaring light turned on or off electronically. In a LCD TV, the pixels are returned on or off electronically utilizing fluid gems to pivot spellbound light

LCD come in numerous sizes 8x1, 8x2, 10x2, 16x1, 16x2, 16x4, 20x2, 20x4, 24x2, 30x2, 32x2, 40x2 and so on. Numerous worldwide organizations like Philips Hitachi Panasonic make their very own extraordinary sort of LCD’S to be utilized in their items. LCD is utilized here to show the estimation of flexion.

**Power Supply unit:**

A power supply unit (or PSU) changes over mains AC to low-voltage controlled DC control for the inward pieces of a PC. Present day PCs all around use traded mode control supplies. Some power supplies have a manual switch for picking input voltage, while others thusly change in accordance with the mains voltage.
A power supply is used to diminish the mains control at 240 volts AC down to something progressively useable, say 12 volts DC. There are two sorts of vitality supply, direct and switch mode. An immediate power supply uses a transformer to diminish the voltage. The AC banner is amended and controlled to convey a high DC voltage.

An AC connector, AC/DC connector, or AC/DC converter is a sort of outside power supply, habitually encased for a circumstance like an AC plug. Connectors for battery-controlled equipment may be depicted as chargers or rechargers.

**PICCCCS:**

Code Composer Studio - CCStudio or CCS is a planned improvement condition IDE to make applications for Texas Instruments-TI embedded processors. Texas Instruments introduced processors join TMS320 DSPs, OMAP system-on-a-chip, DaVinci structure on-a-chip, Sitara applications processors, Hercules microcontrollers, MSP432 microcontrollers, Wireless accessibility microcontrollers and TiVo/Stellar is microcontrollers. It furthermore enables investigating on a couple of subsystems, for instance, Ducati, IVA Accelerator and PRU-ICSS. Code Composer Studio is mainly sketched out concerning embedded endeavor plan and low-level (baremetal) JTAG based examining.

**Implanted C:**

Embedded C is a plan of tongue extensions for the C programming lingo by the C Standards Committee to address shared quality issues that exist between C enlargements for different embedded systems. Introduced C is a plan of lingo extensions for the C programming vernacular by the C Standards Committee to address shared trademark issues that exist between C enlargements for different embedded structures. Really, embedded C programming requires nonstandard growthes to the C lingo in order to support exceptional features, for instance, settled point number juggling, various specific memory banks, and fundamental I/O undertakings. Present day embedded structures are consistently in perspective on microcontrollers, for example CPU’s with facilitated memory or periphery interfaces, anyway standard microchips, using external chips for memory and periphery interface circuits are also ordinary, especially in progressively complex systems. Present day implanted C is frequently founded on microcontrollers (forexample CPU’s with coordinated memory or fringe interfaces), however standard microchips (utilizing outer chips for memory and fringe interface circuits) are likewise normal, particularly in increasingly complex frameworks.

**BLOCKDIAGRAM:**

FIG : WORKING BLOCK DIAGRAM OF SPINAL SUPPORTED S/M

**Discussion**

Spinal supports can be conceived utilizing flex sensors. At the point when the spinal stance changes, the flex sensors set on the lumbar area estimates the flexion in the spine. As the stance changes, obstruction of flex sensor changes in like manner. The yield of the flex sensor is nourished into the preamplifier, which changes over the obstruction varieties in flex sensor to reasonable voltage gain. The voltage is then sustained into the ADC of the microcontroller.

On the off chance that the opposition estimation of the flex sensor lies beneath the limit esteem which is encoded in the microcontroller, the framework causes a ringer sound. So the individual can change the stance independent from anyone else. On the off chance that the obstruction esteem goes past the limit esteem, it works the DC gear engine to solidify the circles of the spinal props. Subsequently helps in recovering the spinal stance.

Spinal support is easy to use and is anything but difficult to wear as though wearing a knapsack. It is cost productive, agreeable, simple to change for custom fit, lightweight and watchful and pulls the shoulders back and rectifies the in a split second to improve your stance.
Conclusion

Numerous strategies are there to treat back agony, which incorporates medical procedure, meds and non-meditative techniques, of which non-meditative strategy is the most ideal approach to treat. As there is no specific strategy for perpetual debilitating, it is smarter to keep experiencing back agony. Thus we have proposed a strategy to avoid back agony by keeping up a decent stance in the working individuals.

A definitive point is to avert back torment and is accomplished with the assistance of microcontroller and flex sensor and the proposed framework is actualized. The planned props are cost productive and is intended to the two people. It avoids slumping and keeping up great stance.

Ethical Clearance- No ethical clearance was necessary for this research work

Source of Funding- Self funded project

Conflict of Interest - Nil
This paper will depict the strategy, ability and properties of hearing and tuning in of sounds and voices. In a few people because of some ineptitude or harm of organ, the individual can’t listen legitimately. So a gadget setup has been made so as to increment improve the listening ability of abandoned people. In the gadget numerous electronic segments have been similar to TL06 Amplifier, resistors, capacitors, battery, receiver, helper jack 3.5mm. The primary point of the venture is to build the extent to low information voices and sounds and from this time forward enhance the sounds. The yields are henceforth intensified and sounds are heard through headphones.

Thus the venture was made with the assistance of programming of called as Multiuse made my National Instruments &Co. The block diagram of the system is shown in Fig. 1 with the Power unit, input unit, amplifying unit and the output unit.

**Fig. 1 Block diagram of hearing aid**

**Material and Method**

There are a few materials utilized in this task so as to improve the listening ability of human, the materials utilized here are as enhancers. The circuit can be
essentially developed on a little, broadly useful Printed Circuit Board just as a Vero board. It works off a 3V DC supply. For this reason, you can use two little 1.5V battery. Continuously keep change S to “off” condition when the circuit isn’t being utilized.

![Circuit Diagram Hearing Aid](image)

This is a modest listening device gadget circuit which works by utilizing only four transistors and a few latent electronic parts. On moving on/off change S to “on” position, the condenser mic distinguishes the real stable flag, that is intensified by transistors T1 and furthermore T2. The enhanced flag goes through coupling capacitor C3 towards the base of transistor T3. The flag is furthermore intensified by PNP transistor T4 to drive a low impedance headphone. Capacitors C4 and C5 are the power source decoupling capacitors.

The circuit can be just built on a little, universally useful Printed Circuit Board just as a Vero board. It works off a 3V DC supply. For this reason, you can use two little 1.5V battery. Continuously keep change S to “off” condition when the circuit isn’t being utilized. To improve the dimension of affectability of the condenser mic, house it inside a little cylinder or pipe. The principle center here is to expand the intensification of the sound. To examine the general conduct of portable amplifier clients concerning time spent in diverse listening situations this examination utilized the information logging capacity of two presently accessible portable hearing assistants as a goal tool. Some of the primary materials incorporate Resistors.

**Findings and Discussion**

The outcomes demonstrates the intensified yield of the info sound, the information sound is thus improved and as indicated by the speaker type. An energizing ongoing advancement is a capacity to give hearing to some reciprocally stunned people through implantation of a gadget that specifically invigorates the consultation nerve (winding ganglion). Despite the fact that this gadget isn’t commonly considered as an amplifier, it plays out a similar reason for people with serious hearing impedence including the two ears. At this composition, 8/12, there are a couple of organizations that make inserts: Cochlear Corp., Advanced Bioinics, Med El Corp., and Neurelec (not accessible in the US).

**Conclusion**

The general example of the portable amplifier clients’ practices, as far as time spent in diverse listening conditions, demonstrated that the listening situations regularly experienced by the portable hearing assistant client were “Discourse Only” circumstances, trailed by “Quiet” situations and afterward by two circumstances with comparable measures of time utilization, “Discourse in Noise” and “Commotion Only”. The conveyance of time spent in listening situations with noise present, i.e., “Discourse in Noise” and “Commotion Only” gives rules to clinician in regards to potential amplifier client profit by clamour decrease calculations and directional mouthpieces. The receiver mode frequently experienced by the hearing aid client was ‘Encompass’ mode, followed all together by “Split” and “Full” directional modes.
The after effect of no critical distinction between ears for the time spent in each microphone may be valuable to the clinician as it exhibits that they may not be putting customers at a disadvantage by choosing a portable hearing assistant without the capacity to convey between ears.

**Ethical Clearance** - No ethical clearance was necessary for this research work

**Source of Funding** - Self Funded Project

**Conflict of Interest** - Nil

**References**

Intelligent Support System for Visually Impaired with Haptic Feedback

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Abstract

Blind people are excluded from most forms of communication and information. This paper suggests a novel approach to support the communication and interaction of deaf-blind individuals, thus fostering their independence. It includes a smart glove that translates the Braille alphabet, which is used almost universally by the literate blind population, into text and vice versa, and communicates the message via SMS to a remote contact. It enables user to convey simple messages by capacitive touch sensors as input sensors placed on the palmer side of the glove and converted to text by the PC/mobile phone. The wearer can perceive and interpret incoming messages by tactile feedback patterns of mini vibrational motors on the dorsal side of the glove. The successful implementation of real-time two-way translation between English and Braille, and communication of the wearable device with a mobile phone/PC opens up new opportunities of information exchange which were hitherto unavailable to blind individuals, such as remote communication, as well as parallel one-to-many broadcast. The glove also makes communicating with laypersons without knowledge of Braille possible, without the need for trained interpreters.

Keywords: Sensory impairment; Wearable device Assistive Technology; Braille; Blind; Haptics; Human-computer interaction; Mobile Communication.

Introduction

Blindness is a sensory-impairment with a loss of vision. The degree of sensory loss in a blind individual depends on the cause of their disability. It can be congenital (by birth) or acquired at later stage in life [1]. Blind individuals are a unique, heterogeneous and marginalized group of individuals whose disability is greater than the sum of the individual disabilities of blindness. There are about 500,000 blind individuals across India. Such people often face social isolation and severe communication, developmental and educational problems. Typically, people with acquired blindness have the opportunity to learn and use Braille for communication. Braille is a tactile alphabet which each character consisting of a combination raised dots in a 6-cell ordered matrix as shown in Fig.1.

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Figure 1: The Braille glyph: a cell of 6 dots

A. Technical Background

There have been several research projects focusing on filling the gap in assistive technologies for blind communication. Mechanical hands for automated finger spelling or different glove systems have been developed over the past decades implementing a variety of alphabets¹. Some of them are discontinued. There are only a few focusing on wearable mobile devices and consequently a human-centered design approach. One such system is the Mobile Lorm Glove², which uses the continuous gestures of the Lorm alphabet. Flat fabric sensors are embedded on the glove to not constrain the smooth gestures. A similar glove system, the DB-HAND ³, implements the Malossi alphabet. Tactile switches on the surface of the palm need to be pressed and pinched.
The WearaBraille prototype uses finger mounted accelerometers (3 on each hand) to detect tapping against a firm surface, hence emulating typing on a keyboard.

B. Overview of Proposed Solution

Our system acts as an interface to facilitate real-time two-way translation between the English text and Braille text (see Figure 2). This information is transmitted via serial communication between the gloves microcontroller unit (MCU) and either a PC or a mobile device with Bluetooth. Like the Lorm Glove, our system provides vibro-tactile feedback to confirm the user input, while doing away with complexity associated with continuous gestures. We instead use a set of discrete symbols of the Braille alphabet that allows a simpler design because sensors and actuators do not require be reading or firing in clusters. Using Braille also lends more simplicity (less buttons) and universality to our system when compared to other region-specific languages like Lorm or Malossi. Also, our device is less obstructive than Weara Braille, since it is worn on only one hand freeing up the other hand for other tasks (when it is not being used for inputting).

C. Organization of the Paper

The rest of the paper discusses the proposed solution, its implementation, and the conclusions drawn from the prototype. Possible application scenarios of this technology and an outlook into further research are briefly discussed toward the end.

Material and Method

As shown in Fig.2, our prototype consists of a glove to be worn on the left hand of the individual, with input side as the palmar side and output side as the dorsal side of the glove. It’s connected to a control unit which can be strapped onto the wrist or forearm. To compose and send a message, the user touches the sensors on the input side, using their right hand, corresponding to a specific Braille character pattern, in a descending sequence from the first dot to the sixth. Each press is confirmed with vibro-tactile feedback from one specific motor on the other side of the glove. After the buttons for a character have been pressed, the user presses a pushbutton to enter that character and move on to inputting the next one. As soon as the pushbutton is pressed, the translated English character is transmitted to a mobile phone via a wireless (Bluetooth) serial channel. The type of Braille used in our system is un-contracted (grade -1), because of its simplicity over grade-2 Braille which uses single cells for common words. When a character or sentence is sent from the mobile phone to the MCU, the translated Braille glyphs of each character are simulated on the dorsal side of the glove by simultaneous activation of vibration motors corresponding to each character in the sequence in which the string is entered. Hence a full-duplex Braille-English translation is achieved for interpretation by a deaf blind user. We have also developed a simple Android application that makes it convenient for the user to send and receive text messages via SMS. If while inputting, the user types ‘send’ followed by a recipients mobile phone number (on the Braille Glove), the app ensures that the message preceding ‘send’ is automatically sent to the specified remote contact. Similarly, when the user’s mobile phone receives a text message, the app transmits it to the glove’s MCU.

Figure 2: Overview of the system
Hardware Implementation

The input unit consists of a matrix of 6 capacitive touch sensors arranged like a Braille cell on the palmar side of the glove. The touch sensors were built by cutting out squares from a double-sided copper PCB. Touching the sensor changes the capacitance of the circuit, which acts as a trigger for the MCU to record the touch. These touch sensors correlate to different cells of the Braille glyph. A pushbutton is used to signal the completion of an entered character.

Figure 3: Input side of the glove

The output unit comprises 6 eccentric rotating mass (ERM) motors arranged similar to the touch sensors, but on the dorsal side of the glove (Fig. 4). Through sequential vibration, they simulate each Braille character as a unique tactile sensation Pattern. Each motor is designed to operate in the range of 1.5-3V.

Figure 4: Output side of the glove

(Vibration motors circled)

B. Software Implementation

The software for the system was implemented in Energia, the open-source programming framework for Texas Instruments MSP430 Launch Pad. The sampling of input data uses event-triggered instructions initialized by either the touch sensors or data arriving in the serial receive buffer, using if control structures. The received data is then compared with the entries in a look-up table (dictionary), using switch-case control structures. The pushbutton is used as an external interrupt triggering transmission of each character while composing messages. Each character is then serial-processed from the glove to the mobile phone of the user or vice-versa via the Bluetooth connection. The algorithm used is presented in the appendix. The software layer of the system also includes an app we developed to enable the messages to be exchanged with other people via SMS.

Findings

Both the input and output modules of our glove prototype perform satisfactorily when communicating with a mobile phone and PC, for all permissible characters. Vibrations from different motors are easily distinguishable as each vibration is perceived locally at the specific location on the dorsal side, corresponding to its Braille cell.
Discussion

The use of a set of discrete symbols (Braille) instead of continuous gestures allows a less complex design because sensors and actuators do not require to be read or fired in clusters to acquire an impulse or to produce a stimulus (there is a one-to-one correspondence between characters and sensor/actuator combinations). Thus, the device uses less parts and is cheaper. Although the current glove is comfortable to wear, a main concern for the future is to decrease the thickness of the glove and simplifying its fabrication by replacing the large number of wires used with stretchable printed circuits. Our system is able to perform the core tasks of real-time full-duplex translation between the English and Braille alphabets and communicating this information between the glove and any remote recipient’s mobile phone, via our app. The next step is to evaluate the usability and learning curve of the system by an experimental study on blind individuals.

Conclusion

The proposed system provides a novel way of interacting with blind individuals. Parallel one-to-many broadcast, which can be particularly useful in a classroom teaching context, is also possible with this device. The translation capability of the glove makes communication even with laypersons who do not understand Braille possible. This eliminates the need for trained personal interpreters for blind individuals. As a consequence, it facilitates interaction of blind individuals with a wider social world, enhancing their independence and ultimately empowering them. Further applications are possible for e.g. integrating our text-to-sensory braille technology with e-books by developing an app could help blind individuals 'feel' entire books.

Ethical Clearance- No ethical clearance was necessary for this research work

Source of Funding- Self Funded Project

Conflict of Interest - Nil

References

Design an Mems based Emergency Alert System for Drivers by Using IOT

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Abstract

Health care system is very important for the public health and economy of any country. In this fast moving world it is very difficult for people to be available for their dear ones all the time to take care of them. This device allows people to monitor the heart rate and temperature of the patient continuously or at regular intervals of time. The details of the person whose driving can be monitored time to time using IOT and during an emergency their location will be sent as a URL. So that people can get to know the condition of their dear ones and not restrict their freedom of being independent as a person. This is done with the help of a microcontroller. This paper also shows the results and calibrations which shows the accuracy of the proposed device under all conditions and driving in a wide area

Keywords— GPS, GSM, URL, IOT

Introduction

The rate at which the heart beats is measured by the amount of contractions that takes place in the heart. Heart rate is defined as the amount of contractions that take place per minute. The heart rate varies due to a variety of reasons such as the absorption of oxygen and excretion of carbon dioxide and the physical needs of the body¹. Bradycardia and Tachycardia are two terminologies that are used to mention the range of heart rate above or below the normal range. The normal range of heart rate is 60-100bpm. Above 100 is termed as Tachycardia and below 60 is Bradycardia. In healthy individuals the heart rate is synchronized with the pulse rate ². But both the terms are technically different as the heart rate measures the contractions of the heart and the pulse rate measures the palpable blood pressure increase throughout the body ³. Due to the explosive growth of the semiconductor industry, various processing techniques for working with silicon (Si) as a substrate material have been developed and successfully established by the semiconductor industries. Now Si is being used for producing small- scale mechanical components of the size of only a few microns ($10^{-6}$m) or even less. The processing techniques are being adopted from the semiconductor processes and further developed for the means of achieving small and reliable structures. The possible applications for such micromechanical devices are countless, and are already being used by the aerospace and automotive industries for pressure sensors and accelerometers. With improvements in processes that allow cheaper mass production of the structures, micromachined components will get more and more important, possibly resulting in a technical revolution when formerly impossible structures can come possible.

Material and Method

The microcontroller with sensors like the heart rate sensor and DHT sensor are used to take the input of heart rate and temperature from the person driving the vehicle and the IoT helps to update the details time to time to a web page where continuously ⁴. The figure 1 and 2 show the block diagram of the transmitter and receiver section. The GPS and GSM are also attached which sends[32-34] text message with a URL of the location to the patients family when the range of values are above
the normal range. The transmitter section contains the heart rate and temperature sensors along with the GPS and GSM.

**Findings**

The research has been successfully completed and the medical variations can be detected while driving and the information’s are transmitted continuously and the web page is refreshed every 3 seconds for better and accurate results. This page shows the heart rate and temperature and automatically refreshes every 3 seconds to give accurate results.

**Discussion**

The research has been successfully completed and the medical variations can be detected while driving and the information’s are transmitted continuously and the web page is refreshed every 3 seconds for better and accurate results. This page shows the heart rate and temperature and automatically refreshes every 3 seconds to give accurate results.

**Conclusion**

This project detects the heart rate and temperature changes in the body and talks about the various factors that causes such variations which lead to a drastic increase or a decrease of these two parameters. These changes are noted with the help of sensors which are connected in wireless communication. Through this research the person’s condition can be monitored and maintained privately as the details are only visible through the ID given to the user’s family.

**Ethical Clearance**- No ethical clearance was necessary for this research work

**Source of Funding**- Self Funded Project

**Conflict of Interest** - Nil

**References**


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An Analysis about the Influence between Individual Characteristics and Occupational Factors Toward Exclusive Breastfeeding (EBF) (Study at Industrial Center of Sidoarjo District)

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Abstract

Exclusive Breastfeeding (EBF) is giving breastfeeding only during the first six months without other supplementary drinks or foods. Every mother has the right to give breastfeeding, including the working mother. Working mother is still considered as the one of the factors that causing the high rate of EBF failure, whereas in industrialized countries 45-60% of workers are reproductive age women. The purpose of this study was to describe and analyze the individual characteristics and occupational factors of EBF by working mother.

This study was observational with cross sectional design. The respondents were 114 working mother. The independent variables in this study were age, education, work unit, and working hours. The dependent variable is EBF.

A total of 47.4% of respondents gave EBF. Most of the respondents were aged between 20-35 years old and gave EBF of 40 respondents (54.8%), and almost half of them aged > 35 years old of 14 respondents (34.1%). Most of the respondents worked in non-shift work and gave EBF of 19 respondents (73.1%). A simple logistic regression analysis found significant influence between age and EBF ($p = 0.036$) and there was a significant influence between working hours and EBF ($p = 0.004$).

We recommended for the company to make a schedule regulation about working mother who are still giving breastfeeding and not to work in shifts until they are ready to work in shift, so they can provide EBF for the infant.

Keywords: Exclusive Breastfeeding, Working Mother, Working Factor, Work Shift

Introduction

Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) are indicators of developmental success in health sector. MMR and IMR are still relatively high across the world, according to World Health Organization (WHO) data in 2013, recorded the world’s IMR rate of 35 per 1000 live births. About 40% of infant death occur in the first month of life. The cause of the death during perinatal / neonatal period is generally related to maternal health during pregnancy, fetal health during pregnancy and maternal / infant delivery process that is asphyxia, hypothermia due to prematurity / BBLR. According to Health Department of Indonesia (2013), fifty-four percent of infant death

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is due to nutritional problems such as less calories and protein. Prevention attempt that can be done to reduce infant mortality due to the problem is to improve the nutrition of infant. The First 1000 Days of Life Movement is an accelerated movement of nutritional improvement adopted from the Scaling Up-Nutrition (SUN) Movement, which aims to reduce the nutritional problem in The First 1000 Days of Life from early pregnancy until 2 years.

Related to the improvement of nutrition in 1000 days of life, several policies have been established, including: Increasing coverage and quality of pregnancy and delivery services; Socialize and monitor the implementation of Law No. 36/2009 about Health and Government Regulation No. 33/2012 about Exclusive Breastfeeding; Increase coverage and quality of nutrition and health services through the provision of supportive personnel, adequate provision of nutritional medicine and supplementation; Increase health and nutrition education activities through a clean and healthy lifestyle culture; and by increasing the commitment of various stakeholders, especially across sectors, businesses and communities to jointly meet family-level food needs.

Exclusive breastfeeding can affect infant mortality rate (IMR) because breast milk can improve and maintain the immune system in infants so they are not susceptible to infectious diseases. According to Indonesia Health Demography Survey data in 2007 shows that infant mortality rate decreased from 39.5% in 2002 to 32.4%. This is because exclusive breastfeeding is getting better.

In Indonesia, the call for exclusive breastfeeding is contained in Government Regulation No. 33 of 2012 about Administration of Exclusive Breastfeeding; paragraph 1. That is, a mother is obliged to give exclusive breastfeeding and the environment around the mother is also obliged to morally support the mother to breastfeed. Every mother has the right to give breastfeeding, including the working mother. The International Labor Organization Convention stipulates that maternity leave for 14 weeks and the provision of breastfeeding support facilities in the workplace shall be held. Labor Law in Indonesia no. 1 Year 1951 provides maternity leave for 12 weeks and breastfeeding opportunities 2 x 30 minutes in working hours. However, working mothers are still considered as one of the factor that causing high rates of breastfeeding failure, whereas in industrialized countries 45-60% of workers are reproductive age women.

The barrier factors of breastfeeding success in working mothers are short time off work, lack of workplace support, short break time at work (not enough time to milking), lack of room for milking, lack of breastfeeding storage, fatigue factor, as well as cultural issues, feel ashamed when milking at work, and lack of mother knowledge about lactation management.

Sidoarjo District is known as the industrial center. Data from Industry and Trade Office of Sidoarjo District stated that in 2007 the number of industries in Sidoarjo District is 5,638 units with 487 big industrial units and 5151 small industrial units category. In 2013 at Sidoarjo District, infants who received exclusive breastfeeding were 47.95% or 11,534 of the 24,055 infants examined. The value is decreased when compared to 2012 coverage of infants who get exclusive breastfeeding of 50.78% or 11,600 of the 22,845 infants. Compared to the 2013 target of 75%, the achievement of exclusive breastfeeding in Sidoarjo District is still far below the target. Various possible factors that lead to low exclusive breastfeeding, among others, increasing number of working mother in order to help the household economy and the use of formula milk that become a trend in society.

This study aims to describe and analyze the characteristic of individual and occupational factors on exclusive breastfeeding by worker mothers.

**Material and Method**

The design of this study was cross sectional with observational study type. The study was conducted at PT X, that engaged in plastic bag and jumbo bag industry. The data was collected for 1 month in October - November 2017. The respondents were 114 people with inclusion criteria who already had children during work and those who had breastfed. The independent variables of this study were individual characteristics (age and education), occupational factors (work units and work hours).

Data collection techniques was in the form of filling the general data questionnaire, job history, history of pregnancy, childbirth and breastfeeding. Analytical methods used include descriptive analysis and bivariate analysis.
Results

Age

Respondent characteristic by age was divided into two categories, namely those aged 20-35 years and > 35 years. The majority of respondents in this study were aged 20-35 years of 73 respondents (64%), and almost half were > 35 years old by 41 respondents (36%).

Education

Respondent characteristic by education was divided into elementary school, junior high school, senior high school and college school categories. The majority of respondents in this study were senior high school graduates of 66 respondents (57.9%), almost half of them were junior high school graduates (33.9%), some were university graduates 12 respondents (10.5%) and elementary school graduates were 3 respondents (2.6%).

Work Unit

In this study, the work unit was divided into two categories namely respondents who work in the office and non-office (packing). In this study, most respondents work in non-office (packing) sections of 93 respondents (81.6%) and a small part who works in the office of 21 respondents (18.45).

Work Hour Rules

In the company where the research was applied shift work system for workers in the production (non-office) i.e morning, afternoon and night shift. Most respondents worked with shift work system of 88 respondents (77.2%). While a small percentage of respondents work without shift work system of 26 respondents (22.8%).

Exclusive Breastfeeding

Nearly half of the respondents who studied exclusively breastfed their infants by 54 respondents (47.4%).

Test Results of the Influence Between Individual Characteristics and Occupational Factors on Exclusive Breastfeeding

<table>
<thead>
<tr>
<th>Table 1. Test Result of the Influence</th>
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<tbody>
<tr>
<td>Independent Variable</td>
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<tr>
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</tr>
<tr>
<td>Age</td>
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<td>Education</td>
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<td>Work Rules</td>
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The result of the influence test in Table 1 shows that the independent variables which significantly influence the exclusive breastfeeding variable are the age and working hours. It can be seen from \( p \) value < 0.05 from logistic regression test of age variable is 0.036 and variable of work rules is 0.004.

One of the factor that influence exclusive breastfeeding is the age of the mother. According to Organization of National Demography and Family Planning, age 20 - 30 years are safe age for reproduction, and in general mother’s ability to breastfeed is better at that age than they who aged over 30 years old\(^{13}\). Based on the results of the study above, we found that there is an influence between age and exclusive breastfeeding, with the age group who give exclusive breastfeeding mostly aged 20-35 as many as 40 respondents (54.8%). While respondents aged > 35 years and give breastfeeding as many as 14 respondents (34.1%). This study is consistent with the study of Handayani (2007) which stated that age influences how breastfeeding mother make decision in exclusive breastfeeding, the older the age, increase their experience and knowledge\(^{9}\). Breast degeneration process regarding the size and alveoli gland encounter a regression which begins at the age of 30 years. So with that process, the breast tends to produce less milk. Younger mother produces more breast milk than older mother\(^{13}\).

This study is also in line with the study of Abdulaziz (2016) conducted on 166 working respondents, of which nearly half of the workers aged 30-34 years were 51 respondents (37\%). The result of the statistical test showed that there is an influence between age and exclusive breastfeeding with \( p \)-value 0.0001. Study that conducted on working women in Nigeria showed that women who are relatively young (≤ 25 years) or too old (≥ 36 years) have a lower prevalence compared with those aged between 26-35 years. This is due to lack of breastfeeding experience on young women. Whereas older women tends to have much experience\(^{14}\). Age also determines the level of maturity of a person in taking a decision to act. Maternal age is crucial to maternal health and related with pregnancy condition, labor and childbed as well as how to nurture and breastfeed their babies. Mother who is younger than 20 years old is still immature and not yet ready in physical and social terms to face pregnancy, childbirth and care for her baby\(^{7}\). According to Hurlock (2008) mother aged 20-35 years, is referred as “adulthood” and also called the reproductive period, emotionally calm, especially when facing pregnancy, labor, childbirth and care for her baby.

The success of exclusive breastfeeding may be affected by the occupational status of the mother. Working mother has the potential to fail breastfeed her baby exclusively due to many factors, one of which is working hours. Working hours may affect exclusive breastfeeding, due to the working hour’s differences between shift working mother and non-shift working mother may affect the condition of the mother. Based on the results of study above, we found that most workers who have shift working hour tend not to give exclusive breastfeeding of 53 respondents (60.2%), and most workers who do not have shift working hour tend to give exclusive breastfeeding of 19 respondents (73.1%). So that there is a significant influence between the rules of working hour and exclusive breastfeeding. This is in accordance with the result of Dina’s study (2016) which stated that the mother who work on shift working hour tend not to give exclusive breastfeeding to her baby (97.7\%)\(^{5}\). The results of this study indicate a significant value with \( p \)-value 0.003 so that there is an influence between mother’s working hours with the success of exclusive breastfeeding. In addition, the result of the study conducted by Alice Lakati (2002) also showed an influence between working with shift and non-shift system to exclusive breastfeeding in the first and second months\(^{7}\). Study conducted by Yi Chun Cheng (2006) on 998 respondents showed similar result that most workers who have shift working hours did not give exclusive breastfeeding of 770 respondents (77.2\%)\(^{3}\). The statistical test showed the influence of occupational factor (working hours rules) on exclusive breastfeeding with \( p \)-value <0.001. Christian (2014) also stated that based on rotational work schedules defined as working in shifts that change periodically, can make it difficult to continue breastfeeding routinely. This was indicated by the result of his research that is 55.2\% of respondents who work are not giving exclusive breastfeeding to the baby.

This condition can occur because the worker mothers shift system has a greater potential for fatigue or stress that affects the physical condition of the mother and can affect lack of milk production. When a mother is in a state of fatigue or stress, the hormone oxytocin will also be hampered so that milk production will also decline. Oxytocin hormone is one of the hormones that can affect milk production. Fatigue will also make the...
mother lazy to breastfeeding her baby and tend to choose more practical formula milk.

**Conclusion**

Almost half of respondents gave exclusive breastfeeding of 54 respondents (47.4%).

Most of the respondents were aged between 20-35 years old and gave exclusive breastfeeding to their infants of 40 respondents (54.8%), almost half of them aged > 35 years old and exclusively breastfeeding of 14 respondents (34.1%).

Most of the respondents with high school education gave exclusive breastfeeding to their infants as 32 respondents (48.5%), half of them had a university education of 6 respondents (50.0%), almost half of them had junior high education of 16 respondents (48.5%), and none of them have elementary education.

Most of the respondents worked in non-office units and exclusively breastfeeding their infants by 44 respondents (47.3%) and the others in the office unit of 10 respondents (47.6%).

Most of the respondents working in non-shift work hours and exclusive breastfeeding of 19 respondents (73.1%).

Based on simple logistic regression test, there is a significant influence between age and working rule on exclusive breastfeeding with \( p-value < 0.05 \).

**Conflict of Interest:** None

**Source of Funding:** Department of Occupational Health and Safety, Public Health Faculty, Airlangga University, Surabaya, Indonesia

**Ethical Clearance:** The research proposal has been approved by Health Research Ethical Commission of Public Health Faculty Airlangga University, number: 120-KEPK 2017. All respondents were given explanation and information about the purposes and methods of the research, and also had signed informed consent forms.

**References**

An Analysis About the Influence between Occupational Factors and Work Environment on Abortus Occurrence in Female Workers at Pt. X Sidoarjo

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Abstract

Abortus is secretion of the conception before being able to live outside the womb with weight less than 1000 grams or gestational age less than 20 weeks. The risk factors for the miscarriage occurrence are encountered in PT.X workers which located in Sidoarjo district, including the existence of company regulations to apply shift work for workers and workers’ perceptions about their work environment. The purpose of this study was to analyze the effect of job risk factors such as working hours, work shifts, and work environment factors such as noise, temperature, and vibration with the occurrence of abortus in female workers at PT. X Sidoarjo District.

The design of this study was cross sectional with observational study type. The respondents of this study were female workers with total of 192 people. The independent variables of this research were work factors and work environment factors. The dependent variable in this study was the incidence of abortus in female workers.

A total 28.64% of the respondents had experienced abortus. Logistic regression analysis found that there was a significant correlation between work shift and abortus incidence \( p = 0.020 \) and between exposure of the machine-induced vibration and abortus occurrence \( p = 0.006 \).

We recommended for the company to make a schedule regulation about the work shift and taking routine enviromental measurements, so the risk of abortion occurrence in female workers due to occupational factors and work environment can be minimized.

Keywords: Duration of Working Hours, Work Shifts, Physical Work Environment, Abortus Occurrence, Female Workers.

Introduction

Life and work are something that can’t be separated, if people want to live then they have to work. For human, work is a basic need for the fulfillment of needs and desires, both for men and women. Work is defined as an economic activity undertaken by a person with the intention of obtaining or help to obtaining an income or profit in his life. The more job opportunities which currently occur, does not rule out women entry into the job world¹.

Along with the development of the industrial world, female and male workers are often exposed to various risk factors that potentially threaten their health, including reproductive health. WHO mentions reproductive health concerning processes, functions, and reproductive systems at the stage of life. Thus
reproductive health is an important element for the health of both women and men. One of the reproductive problems for working women is a pregnancy disorder in which case is the incidence of abortus. Abortus is the secretion of conception before being able to live outside the womb with fetal weight less than 1000 grams or gestational age less than 20 weeks.

WHO data suggests an estimated 4.2 million abortus occur annually in Southeast Asia, with details: 1.3 millions occur in Vietnam and Singapore, 750,000 to 1.5 million in Indonesia, 155,000 to 750,000 in Philippines, and 300,000 to 900,000 in Thailand, as well as no estimates of abortus in Cambodia, Laos and Myanmar. In Indonesia, the current prevalence of Abortus is currently estimated at 7-14% i.e 560,000 - 1,100,000 incidents of abortus. The number of abortus in Indonesia is quite high. It is estimated that the contribution of abortus to maternal mortality can reach 30-50 percent. The most common pregnancy complication in pregnancy especially in the first trimester is abortus. The main cause of maternal death are bleeding (60%), infection (25%), gestosis (15%) and abortus, including bleeding in early pregnancy. As a result of the bleeding 28% can cause maternal death, it is unpredictable and the occurrence is very abrupt.

Several factors are predisposing for abortus such as parity factor and mother’s age. The risk of abortus is higher with increased parity and maternal age. According to the author’s opinion, the age of pregnant women will affect the incidence of abortus. The older the pregnant women the more likely the abortus will occur. The theory conveyed by Littler (2010) that is from a number of abortus that occurred, he found that if the mother is older than 35 years old then the risk factor affecting abortus is higher. The frequency of clinically detectable abortus is increased by 12 percent in women younger than 20 to 26 percent in those over 40 years old.

One of the risk factors of abortus in working women who is pregnant arises from occupational activity and work environment called occupational risk factors. Several previous studies have shown that long working hours with the work shift system and exposure to physical factors in the workplace, such as lifting and standing activities, can increase the risk in pregnant women. Factors which is related to the female work environment such as exposure to an anesthetic gas, noise, temperature and vibration may be associated with a risk of spontaneous abortus.

The older the women’s age during pregnancy is a strong risk factor because it deals with the quality of the ovum rather than the woman’s ability to give birth. However, miscarriage that occurs in the workplace is also not uncommon, this is due to the existence of known hazard factors and potentially cause the problem of pregnancy which is the occurrence of abortus.

The presence of reproductive health disorder experienced by female workers can lead to lack of work productivity resulting in inefficient production costs. This is due to the higher reproduction disorder experienced by female workers, then the level of likelihood of absenteeism will also be higher so it will decrease the value of work performance and productivity.

The aim of this study was to analyze the influence of job risk factors such as working hours, work shifts, and work environment factors such as noise, temperature, and vibration with the occurrence of abortus in female workers at PT. X Sidoarjo District.

Material and Method

The design of this study is cross sectional with observational study type. The respondents of this study were female workers with total of 192 people. The independent variables of this research were job factors (long working hours and work shifts) and work environment factors (noise, temperature, and vibration). While the dependent variable in this study was the incidence of abortus in female workers.

This study was conducted at PT. X located in Sidoarjo District and implemented from October to November 2017. PT. X is a company engaged in the manufacturing of plastics.

Data collection techniques were included general data, job history (working hours and work shifts), work environment data (noise, temperature, and vibration), and pregnancy history by filling out the questionnaire. Analytical methods were used descriptive analysis and bivariate analysis.

Findings

Duration of Work

The duration of respondent’s working hours in this study was divided into two categories, namely <
8 hours and ≥ 8 hours. Most of the respondents in this study worked ≥ 8 hours as many as 190 (98.95%) and 2 respondents worked < 8 hours (1.04%).

**Working Shift**

In the company where the study was conducted, they applied shift work system for workers in the production (non-office) i.e morning shift, afternoon and night. Most respondents work with shift work system of 145 respondents (75.52%). While a small percentage of respondents work without shift work system of 47 respondents (24.47%).

**Noise**

Based on the result of the study, we found that most of the respondents feel that their work environment is noisy as many as 150 respondents (78.12%) and 42 respondents (21.87%) stated that their working environment is not noisy.

**Test Results of the Effect Between Occupational Factors and Work Environment on Abortus Occurrence in Female Workers**

**Table 1. The Test Results of the influence**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Category</th>
<th>Abortus Occurrence</th>
<th>p-value (0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes N (%)</td>
<td>No N (%)</td>
</tr>
<tr>
<td><strong>Duration of Work</strong></td>
<td>≥ 8 working hours</td>
<td>55 (28.94)</td>
<td>135 (71.05)</td>
</tr>
<tr>
<td></td>
<td>&lt; 8 working hours</td>
<td>0 (0)</td>
<td>2 (100)</td>
</tr>
<tr>
<td><strong>Working Shift</strong></td>
<td>Shift</td>
<td>48 (33.10)</td>
<td>97 (66.89)</td>
</tr>
<tr>
<td></td>
<td>Non Shift</td>
<td>7 (14.89)</td>
<td>40 (85.10)</td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>Yes</td>
<td>42 (27.81)</td>
<td>109 (72.18)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>13 (31.70)</td>
<td>28 (68.29)</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>Yes</td>
<td>49 (28.82)</td>
<td>121 (71.17)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>6 (27.27)</td>
<td>16 (27.27)</td>
</tr>
<tr>
<td><strong>Vibration</strong></td>
<td>Yes</td>
<td>30 (40)</td>
<td>45 (60)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>25 (21.36)</td>
<td>92 (78.63)</td>
</tr>
</tbody>
</table>
The result of the test in Table 1 shows that the independent variables that have significant effect on the variable of *abortus* occurrence are work shift variables and vibration variables due to the exposure of the machine at work. It can be seen from the probability value (p-value) of logistic regression test of working shift variable is 0.020 and the vibration variable is 0.006.

One of the occupational factors that affect the incidence of *abortus* in female workers is the presence of work shift in the work. Work shift includes rotation variable and irregular work schedule. Study showed that the more irregular hours a person has to work, the greater the circadian cycle changes, the greater the pressure on the worker so that it can interfere the reproductive system. Women who work on afternoon and night shifts, rotation or schedule changes require greater attention. Work shift is also associated with the increase of miscarriage in the first trimester, preterm birth, and low birth weight.

Based on the results of the study above, we obtained the results of female workers who run the work shift never experienced the occurrence of *abortus* that is equal to 33.10% with a significance value of 0.020. This study was in accordance with Eskenazi’s (1994) study, based on a case-control study which found an increased risk of spontaneous *abortus* for work shift and work at night. MacDonald et al also found that female workers who were working with the shift system may increase the risk of spontaneous *abortus*. Other studies conducted in China have also found that women who work with irregular working hours or rotation shift systems will increase the risk of miscarriage.

The mechanism that may underlies the causal relationship between night work and miscarriage is the recurrence of circadian rhythm in night workers and is associated with the decrease of melatonin secretion from lack of sleep. This can interfere sex hormone homeostasis, implantation and fetal growth. In addition, if this thing continues to occur during pregnancy it is known to increase the risk of spontaneous *abortus*. This theory is supported by study conducted in Thailand which showed that work shift will lead to the emergence of irregular working hours. It may be associated with the increased risk of spontaneous *abortus* and reduced fertility. The mechanism which involved in the process may include changes in circadian rhythm along with hormonal concentration changes, which may affect both the conception and normal development of the fetus.

The cohort study on Nurse Health showed significantly increased estradiol levels and decreased melatonin excretion after several nights of work.

*Abortus* provides general symptom of abdominal pain due to uterine contraction, bleeding and along with the expenditure of all or part of the conception. The forms of bleeding vary greatly in small amounts and last for a long time, then at the same time in large amounts with clots, and as a result of bleeding can cause symptoms such as shock, increasing pulse, low blood pressure, anemic appearance, and cold fingertips.

The vibration which felt by the body due to the use of the machine while working contributes to the occurrence of various reproductive problems, especially in pregnant women. In addition to causing impaired menstruation, exposure to the vibration of the engine can also cause miscarriage. Based on the results, we obtained that respondents exposed by a vibrating machine experienced *abortus* as much as 40% with a significance value of 0.006. This study is supported by a study conducted in America which stated that persistent exposure to vibration and noise in pregnant women can increase the risk of negative reproductive effects such as infertility, menstrual disorders, spontaneous *abortus* and premature birth. Exposure to vibration can cause impaired blood circulation in the pelvic area of pregnant women.

The effect of vibration released from noise are rarely studied, however, one study in Europe showed that women who are often affected by vibrations resulting from their work can cause serious problems for their reproductive health such as toxemia, complications of labor and may even increase perinatal mortality.

**Conclusion**

As much 55 respondents had (28.64%) had experienced abortion in their life.

Most of the respondents work with ≥ 8 hours duration and have experienced abortion incidence by 55 respondents (28.94%). While respondents who work with a working time < 8 hours, only 2 people and never experienced abortion.

Most of the respondents who work in work shift and have experienced abortion occurrence by 48 respondents (33.10%).
Most of the respondents who felt their working environment is noisy and have experienced abortion is 42 respondents (27.81%).

Most respondents who felt their working environment is hot and often feel swelter at work and have experienced abortion is 49 respondents (28.8%).

A small percentage of respondents who work with a vibrating machine were constantly exposed to engine vibrations and have experienced abortion incidence are 30 respondents (40%).

Based on the result of statistical test, there was a significant effect between work shift, and vibration exposure on the occurrence of abortion with \( p \)-value \(<0.05\). Work shift will result in irregular working hours. It may be associated with the increase of spontaneous abortion and reduced fertility risk. In addition, persistent vibration and noise in pregnant women may increase the risk of negative reproductive effects such as infertility, menstrual disorders, spontaneous abortion and premature birth.

**Conflict of Interest:** None

**Source of Funding:** Departement of Occupational Health and Safety, Public Health Faculty, Airlangga University, Surabaya, Indonesia

**Ethical Clearance:** The data was collected after the study proposal passed the ethical clearance and passed by Health Research Ethics Commission of Faculty of Public Health Airlangga University. All study respondents have been given explanation and information about the purpose and method of this study and have signed the form of willingness to be a respondent.

**References**

Analysis of the Effect of Work Environment Against Pregnancy Disorders to the Female Workers in PT.X

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Abstract

Pregnancy disorders are complications that occur to pregnant women. Pregnancy disorders that can occur in pregnant women are excessive nausea, vomiting, seizures, loss of consciousness, fetal distress, obesity, excessive headaches, hypertension and abortion. The risk factors of pregnancy disorders to the workers in PT.X located in Sidoarjo District, including the work environment of female workers who are noisy, hot, dust, odor and the use of irritant materials. The purpose of this research was to analyze the effect of work environment factors such as noise, heat, dust in the workplace, the smell of stinging and the usage of irritant materials with pregnancy disorders in female workers at PT. X Sidoarjo District.

The research method used in this research was cross sectional with observational research type. The respondents of this research were 160 women. The independent variables of this research were work environment factors (noise, temperature, dust, odor, and irritant materials). While the dependent variables in this research was pregnancy disorder in female workers. This research was done at PT. X located in Sidoarjo District and implemented from October to November 2017.

A total of 78.12% of the respondents had experienced pregnancy disorders. Logistic regression analysis found significant effect between noise with pregnancy disorder (p = 0.023) and 78.75% of the respondents exposed by the heat temperature of the work environment with pregnancy disorder (p = 0.003). Most respondents felt their work environment smelled sting with pregnancy disorder (p = 0.031) that were as many as 111 respondents (69.38%). Generally respondents feel their work environment is hot, often feel the heat while working and there is a stinging smell in the workplace.

Keywords: Noise, Temperature, Pungent Smell and Pregnancy Disorder

Introduction

Pregnancy is a stressful maturity crisis, but it is valuable because the woman prepares herself to provide care and assume greater responsibility. It requires the mastery of developmental tasks such as receiving a pregnancy, identifying the role of the mother, rearranging the relationship between mother and daughter and herself with her partner, building rapport with the unborn child and preparing for the experience of labor.¹

Reproductive health according to the World Health Organization (WHO) is a complete physical, mental and social welfare and not just the absence of disease or weakness, in all matters relating to the reproductive system and its functions and processes.

Women have an important role in various aspects of life. Today, their roles are increasingly prominent along...
with the increase in opportunities and potentials. To support the success of running its role, women’s health needs to get attention. One of the health problems faced by women is the problem of reproductive health. Efforts to maintain reproductive health should start early and continuously in line with the increased risk of various diseases affecting female reproduction. Research conducted in 15 countries states that female workers are an important category to be considered from a work health standpoint.

Reproductive health disorders referred to here include all types of physical disorders in the human reproductive system, such as irregular menstruation, impotence, infection of the reproductive system, the spread of sexually transmitted diseases, infertility, unhealthy pregnancy, early birth, breastfeeding disorders and so on.

In addition to the impact on the success of its role, reproductive health is also a very important thing for the continuation of the next generation. Working women also have implications for female reproductive health, such as experiencing sexual harassment, stress, menstrual disorders, miscarriages, premature birth and so on. The disorder of this disorder that will affect the health of mother and child.

The work environment can also affect the reproductive health of working women. Dirty factory environments, too long working hours without sufficient rest periods, or a rigorous and rough supervision system in factories can disrupt menstrual regularity or may even lead to miscarriage. Further protection of labor rights to maintain reproductive health by companies such as menstruation rights, maternity leave, maternity leave, breastfeeding rights, the right to receive health services related to the reproductive process, the availability of baby care in the company and others will affect the reproductive health of workers.

Based on research on incident data of reproductive health problems from 254 female workers interviewed, 37.79 percent said they had experienced menstrual and vaginal disruption, 20.47 percent had prolonged periods of menstruation, and 8.66 percent had prolonged leucorrhea disruption at work.

There are 6 female laborers who claimed to have experienced pregnancy disorder in the form of abnormal babies due to hard work in the company, 12 female laborers are experiencing birth birth disturbance. Of that number, 4 of them suffered from miscarriage due to work accident in the company environment, 3 female workers experienced bleeding while doing the work. In addition, 32.28 percent of respondents admitted experiencing milk swelling disorder and also found 19 cases of IUD women workers experience bleeding disorders when work.

Those who suffer from these disorders admit that the disorder is caused by work fatigue, high workload, unhealthy environmental conditions or the treatment they receive in the company. For example, some of their reproductive health rights are not given.

The purpose of this research is to analyze the influence of environmental risk factors such as noise, heat, dust, odor and irritant materials with pregnancy disruption in female workers at PT. X Sidoarjo District.

**Material and Method**

The research method used in this research was cross sectional with observational research type. The research respondents amounted to 160 people with inclusion criteria who during work have been pregnant and have children. Research Place at PT. X. PT X is a company engaged in the plastic bag and jumbo bag industry. The company is located in sidoarjo area. Implementation of the research in October - December 2017.

The independent variables of this research were the hazards of the work environment (noise, heat, dust, pungent odor and irritant materials). The dependent variable of this research was pregnancy disorder. Data collecting technique consists of filling in general data questionnaire, job history, history of pregnancy disorder and work environment hazard (noise, heat, dust, pungent odor and irritant). Analytical methods used include descriptive analysis and bivariate analysis.

**Findings**

**Noise**

Based on the result of research, it is found that most respondents feel that their work environment is noisy, as many as 120 respondents (75%) and 40 respondents (25%) stated their work environment is not noisy.

**Heat**

Based on the research result, it is found that most...
of the respondents stated that their work environment was hot, 126 respondents (78.75%) and 34 respondents (21.25%) stated that their work environment was not too hot.

**Dust**

Based on the result of the research, 98 respondents (61.25%) stated that their work place is dusty and 62 respondents (38.75%) stated that their work place is not dusty.

**Strong scent**

Based on the result of the research, there were 111 respondents (69.38%) stated that their workplace environment smells strong and 49 respondents (30.62%) stated that their workplace environment is not smelly.

**Irritant Materials**

Based on the results of the research, 64 respondents (40%) stated that their workplace environment uses irritant materials and 96 respondents (60%) stated that their workplace environment does not use irritant material.

**Pregnancy Disorders**

Based on the results of the research, there were 125 respondents (78.12%) stated that they experienced pregnancy disorder and as many as 35 respondents (21.88%) stated that they did not suffer from pregnancy disorder.

**Test Results About The Effect of Occupational Health Dangers to Pregnancy Disorders**

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Category</th>
<th>Dependent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td></td>
<td>Pregnancy Disorder</td>
</tr>
<tr>
<td>Noise</td>
<td>Yes</td>
<td>99 (82,5)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>26 (65)</td>
</tr>
<tr>
<td>Heat</td>
<td>Yes</td>
<td>105 (83,3)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>20 (58,8)</td>
</tr>
<tr>
<td>Dust</td>
<td>Yes</td>
<td>78 (79,5)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>47 (75,8)</td>
</tr>
<tr>
<td>Sting Smell</td>
<td>Yes</td>
<td>92 (82,8)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>33 (67,3)</td>
</tr>
<tr>
<td>Irritant Materials</td>
<td>Yes</td>
<td>52 (81,2)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>73 (76,0)</td>
</tr>
</tbody>
</table>
The results of the effect test in Table 1 show that the dependent variable that significantly affects pregnancy disorders are noise, heat and odor. This can be seen from the probability (p-value) of logistic variable noise regression test is 0.023 (p <0.05), the hot variable is 0.003 (p <0.05), the odor variable is 0.031 (p <0.05).

One of the factors that affect pregnancy disorder in pregnant women is noise. Based on the results of the research above, obtained the results of female workers working in a noisy work environment never experienced pregnancy problems (82.5%) with a significant value of 0.023. This research in accordance with the latest research also states that, exposure to noise in pregnant women has the potential to cause hearing loss in babies conceived. Even in this research mentioned can be up to 80% in pregnant women who work in a noisy work environment. The assumption of exposure to noise that can damage the ear is only intended for those who have been born, because often exposed to noise directly on their ears. Meanwhile, unborn babies are still protected from the noise inside the uterus. Research conducted at the Institute of Environmental Medicine (IMM) at Karolinska Intitute, Stockholm, Sweden denied everything. Precisely in this research, it is advisable to pregnant women to avoid exposure to noise during the time during their pregnancy.

In a research published in the Journal of Environmental Health Perspectives, about 1.4 million children born in Sweden since 1986 and 2008 were included. Research data taken is the mother’s work, mother’s habits, age, ethnicity, BMI, smoking or not, socio-economic and holiday taken by the mother. The results show, for full-time and full-time mothers, the Hazard ratio is adjusted for hearing dysfunction, where the comparison associated with noise exposure when the mother works larger than 85dB and less than 75dB is 1.27 (95% CI). As for the group of pregnant women who work full time, his HZ ratio is 1.82 (95% CI). Therefore, The Swedish Work Environmental Authority, recommends that pregnant women avoid exposure to noise up to 80dB.

This research is supported by a research conducted in the United States that continuous noise in pregnant women can increase the risk of negative reproductive effects such as infertility, menstrual disorders, spontaneous abortion and premature birth. A hot work environment is felt by the body due to the use of production machinery that produces heat while working to contribute to various reproductive problems, especially in pregnant women. In addition to causing dehydration in pregnant women, heat can also cause miscarriage and fetal distress.

Based on the results of the research obtained respondents exposed to heat experienced pregnancy disorders as much as 83.3% with a significance value of 0.003. The research was supported by a research by scientists from Queensland University of Technology has found that rising temperatures raise the rate of stillbirths and babies born prematurely. Professor Adrian Barnett of the Institute of Biomedical Health and Innovation at Queensland University of Technology led a research looking at the incidence of preterm birth and death in Brisbane for four years from 2005. Out of a total of 101,870 births, 653 or 0.6% number of stillborns. Professor Barnett’s research records the weekly temperature, humidity and air pollution levels for each pregnancy. According to him, the lowest risk is in the coldest weeks, and the warm weekly temperature of 23 degrees celsius is as dangerous as the hottest weeks. Other studies have looked at the relationship between temperature and premature birth. The research by Queensland University of Technology is the first to investigate the relationship between temperature and stillbirth.

Professor Adrian Barnett found that rising temperatures increase the risk of stillbirths, especially when the early stages of pregnancy are before 28 weeks. We estimate at a temperature of 15 degrees C, there will be 353 stillborns per 100,000 pregnancies, compared with 610 stillborn babies per 100,000 pregnancies born at 23 degrees C. Increasing temperature also shortens the time of pregnancy. That is, more premature infants often have long-term serious health problems such as cerebral palsy and visual and hearing impairment. Women should avoid hot pools or Jacuzzis during pregnancy because they can cause miscarriages and dehydration caused by heat and sweating can be harmful to the fetus and affect birth.

A work environment that has a strong smell can affect pregnancy disorders such as dizziness, nausea and excessive vomiting. Based on the results of the research above repondent exposure to the stinging smell of pregnancy disorders as much as 82.8% with a significance value of 0.031. This research is supported
by research conducted by hutahaean. Every first trimester pregnant women experience nausea and vomiting. This is normal and common in pregnancy especially in the first trimester. Almost 45% of women experience vomiting early in pregnancy and up to 90% of women experience nausea. Nausea usually occurs in the morning, but can also arise at any time and night.10

Emesis gravidarum occurs in 60-80% primigravida and 40-60% in multigravida (Wiknjosastro, 2002). Denise (2009) suggests about 51.4% of women experience nausea and 9.2% of women experience vomiting. The highly pathological state of hyperemesis gravidarum is much less common than logical nausea and vomiting, with a very pathological hyperemesis gravidarum occurring in 1 per 500 pregnancies. In order not to arrive at severe conditions, good adaptation is needed to the situation. Adaptation can be reflected in the behavior of the mother overcome her nausea vomiting.11

In a research conducted many that occurred during pregnancy, mostly due to hormonal changes. Increased pregnant hormone hormones are estrogen hormones that will trigger an increase in kiss power in pregnant mothers.12,13 Research conducted by Philadelphia’s Monell Chemical Senses Center in the US states that women of childbearing age are more sensitive to scents. Even women who are not of childbearing age (under puberty and postmenopausal women) have the same sensitivity or olfactory power. In other words, the olfactory sensitivity of pregnant women is caused by the hormone estrogen.12,13

Further research by Yvonne Bohn, MD, author of “The Mommy Docs’ Ultimate Guide to Pregnancy and Birth” says that not only estrogen but human chorionic gonadotropin or HCG that occurs in pregnant women in the first trimester will trigger nausea, vomiting and smell more sensitive to the smell around it.

**Conclusion**

Most of the female workers respondents had experienced a pregnancy disorder of 125 respondents (78.12%) and as many as 35 respondents who stated never experienced pregnancy disorder.

Most of the respondents working in the noisy work environment and had experienced a pregnancy disorder of 99 respondents (82.5%) and a small proportion of respondents 14 respondents (35%) who did not work in a noisy environment and did not have a pregnancy disorder.

Most of the respondents felt their work environment was hot and had experienced pregnancy disorder of 105 respondents (83.3%) and a small part who did not feel the work environment was hot and never had a pregnancy interruption of 14 respondents (41.1%).

Most of the respondents who felt their work environment smelled sting and had experienced pregnancy disorder 92 respondents (82.8) and a small part who did not feel their work environment smelled sting and never experienced pregnancy disorder 16 respondents (32.6%).

Based on statistical test results, there is significant influence between noise, heat and odor to pregnancy disorder with p-value <0.05. Working in noisy spaces more than 85dB can cause emotional changes in the mother and can cause fetal distress. In addition, continuous heat and odor in pregnant women can increase the risk of pregnancy disorders: excessive nausea, dizziness and dehydration in the mother and fetus.

**Conflict of Interest:** None

**Source of Founding:** Department of Occupational Health and Safety, Public Health Faculty, Airlangga University, Surabaya, Indonesia

**Ethical Clearance:** The research proposal has been approved by Health Research Ethical Commission of Public Health Faculty Airlangga University. All respondents were given explanation and information about the purposes and methods of the research, and also had signed informed consent forms.

**References**


Factors Related to Work-Life Balance among Occupational Health Nurses In Thailand

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Abstract

The present study is a descriptive research design aimed at exploring the factors associated with work-life balance among occupational health nurses of Thailand. Data was collected using 455 questionnaires sent by mail, 287 of which were returned for a return rate of 50.98 percent. The related factors were analyzed using multiple linear regression.

According to the findings, the overall work-life balance of occupational health nurses is moderate with a mean (M) and standard deviation (SD) equal to 3.44 and 0.38, respectively. When categorized by individual factors, involvement balance was found to be high (M=3.58, SD = 0.52), while satisfaction balance and time balance were found to be moderate (M = 3.43, SD = 0.52 and M = 3.43, SD = 0.57). The factors associated with work-life balance included marital status, income sufficiency, age, family support, work experience, social support, number of hours worked, role ambiguity and role conflicts. The variables capable of co-predicting variances in work-life balance included age, income sufficiency, number of hours worked, role conflict, role ambiguity, and family support. The linear predictive coefficient was 37.0; therefore, the above predictive factors should be applied to the development of programs for promoting work-life balance for occupational health nurses in the future. (204)

Keywords: work-life balance, occupational health nurse, Thailand

Introduction

“Work-life balance” is a key factor for the working aged population. If employees are able to achieve good balance between work and family life, employees will enjoy good physical and mental health which in turn boosts work efficiency, quality, and production performance.1,2,3 On the contrary, if employees are unable to achieve this balance, the imbalance will lead to fatigue, depression, chronic disease, and problems with familial relationships as well as reduced work performance, lower work satisfaction, and eventual resignation.4,5

According to the Health-Related Quality of Life Index among Thai Nurses, health-related quality of life (HRQOL) was found to be lower among Thai nurses than other occupational groups.6 Furthermore, satisfaction about work-life balance required improvement and should be corrected.7 Therefore, the need to search for causes and problem-solving methods is both essential and urgent before nurses become ill or resign from services, which would result in a nursing shortage leading to an impact on health and health care standards for the public.

The economic growth in Thailand has caused the country to have a need for additional labor. Thus, labor has moved from agriculture to industry with increased mobility in the labor market. Hence, the current labor force is at a greater risk for both disadvantages and
Clause 2 of the Ministerial Regulation on Labor B.E. 2548 (A.D. 2005) stipulates that business facilities with 200+ employees have regularly assigned professional nurses to provide health care services for employees. As a result, the nursing role has expanded to include working in business facilities as a major force in searching for and preventing risk factors, including the promotion of good health and well-being among the working age group. Based on data from the Department of Industrial Works in 2014, there were 5,109 business facilities with 200+ employees in Thailand. At present, however, the number of nurses who have passed 60 hours of short-term occupational health nursing courses are only 3,055 people. Therefore, there is a shortage of professional nurses to meet the demands of business facilities. Consequently, part-time nurses are hired to provide health care services for employees. According to the study of Thanyarat Sukbua (2009), 67.9 percent of professional nurses working in business facilities work part-time. The limited number of nurses has forced some nurses to work at more than one business facility or to work additional overtime, a rate of 40.3%. Consequently, many nurses (43.3%) work 9-16 hour work shifts per day. Thus, nurses have little time for rest and relaxation with less time to care for themselves or participate in family activities. The aforementioned situation potentially leads to impact on relationships with the people surrounding the nurses. Furthermore, quality of life and service provision efficiency are also affected. Most importantly, the overall health of the nurses is subject to impact. Current statistics on the illnesses/injuries of nurses shows the rate of high blood cholesterol levels to be 26.1 percent, while the rate for hypertension was 7.1 percent and psychological problems reported as work-related stress at a rate of 53.6 percent, all of which can result in a work-life imbalance.

According to the literature review, multiple factors influence work-life balance; for example, work factors including excessive roles and duties, lack of support, number of hours worked per week, work schedule and excessive workloads are key factors influencing work-life balance. In addition, family factors including number of children, family support and personality differences play an important part in work-life balance. The above findings concur with the findings of a study done by Juthaporn Nubudt who that found age, number of dependent children, division/department workload and mean number of hours worked per week to be correlated with work-life balance. Obviously, work-life balance depends upon one or more of the above mentioned factors.

Nevertheless, no studies have been conducted on work-life balance among occupational health nurses. Therefore, the researcher’s interest is in exploring the factors correlated with the work-life balance of occupational health nurses by applying the work-life balance concept of Greenhaus, Collins, & Shaw (2003), which is composed of time balance, involvement balance, and satisfaction balance as the conceptual framework for the present study.

Method

Population and Sample

The present research is a cross-sectional study. The population and sample for the study are occupational health nurses working in every type of business facility registered with industrial estates in the eastern region of Thailand with 200+ employees in 2017. The sample size was calculated by using Daniel’s formula, by which a sample size of 230 people was obtained. In order to account for attrition from the sample, another 30 percent was added. Therefore, the sample used in this study was 300 people.

Sampling Method

Multi-stage random sampling was used for the selection of the sample. Furthermore, provinces that meet inclusion criteria, Chonburi and Rayong, were purposively selected and two industrial estates from each province (Amata City and Laem Chabang from Chonburi, and Map Ta Phut and Eastern Seaboard from Rayong) were also selected. The ratios were divided by industrial estate and business facility size, while the business facilities were randomly selected from a list of names in the ratios obtained. The nurse respondents were selected from the list of randomly selected business facilities at a rate of two nurses per facility until the total number of subjects for the sample size was reached.

Research Instrumentation: The questionnaire employed in the study contains the following five parts:

Part 1: The part of the questionnaire on general information contains questions regarding gender, age, marital status, level of education and mean monthly
income. Family-related information includes questions about the number of dependents requiring care and income sufficiency. Work-related information included questions about type of work, work schedule, number of workplaces, work experience, occupational health training and number of hours worked per week. The questions were multiple-choice and open-ended (13 items).

Part 2: The part of the questionnaire on social support in the workplace contains one multiple-choice question. The researcher translated the questionnaire from the instrument created by Thompson & Prottas\textsuperscript{16}, a total of 12 items. The responses were rated on the 5-point Likert scale as follows: strongly disagree to strongly agree.

Part 3: The part of the questionnaire on perceived work roles and responsibilities contains one response the researcher had translated from the questionnaire of Glissmeyer, Bishop & Fass\textsuperscript{17} the questionnaire was composed of ambiguity (6 items) and role conflicts (8 items) for a total of 14 items. The responses were rated on the 5-point Likert scales as follows: least agreement to most agreement.

Part 4: The part of the questionnaire on family support contains one multiple-choice response that was measured by applying the questionnaire of Tannida Thipawatee\textsuperscript{18}, in which responses were rated on the 5-point Likert scales as follows: least agreement to most agreement.

Part 5: The part of the questionnaire on work-life balance that contains one multiple-choice response in which the researcher applied the questionnaire on work-life balance of Sayamon Akekulanan\textsuperscript{19}, which was created based on the concept of work-life balance of Greenhaus, Collins, & Shaw. The responses were rated on the 5-point Likert scales as follows: least agreement to most agreement for a total of 35 items.

Data Analysis

Descriptive statistics, Chi-Square analysis, Pearson’s Product Moment Correlation Coefficient and Regression Analysis were used for data analysis.

Results

According to the findings, most of the sample were composed of females (74.6%) aged between 30-44 years at 49.1 percent. In terms of marital status, 49.1 percent of the sample were married; and most had graduated with bachelor’s degrees (90.1%). Most had never passed training for professional nursing (63.4%) and only worked as an occupational health nurse part-time (71.1%). Most of the nurses worked as occupational health nurses at more than one facility (58.2%) and had work schedules based on shifts (69.4%) Most of the nurses work more than 60 hours/week (50.4%).

Work-life Balance: According to the findings, the work-life balance of the occupational health nurses was moderate. When categorized individually, the findings indicated that involvement balance was high, while satisfaction balance and time balance were moderate (Table 1).

Table 1 The overall number and percentage of work-life balance and categorized individually.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work-life balance</td>
<td>3.54</td>
<td>0.45</td>
<td>high</td>
</tr>
<tr>
<td>Time balance</td>
<td>3.43</td>
<td>0.57</td>
<td>moderate</td>
</tr>
<tr>
<td>Involvement balance</td>
<td>3.58</td>
<td>0.52</td>
<td>high</td>
</tr>
<tr>
<td>Satisfaction balance</td>
<td>3.67</td>
<td>0.59</td>
<td>moderate</td>
</tr>
</tbody>
</table>

Relationship between Independent Variables and work-life Balance of occupational health nurses by Chi-Square Statistics: According to the findings, Income sufficiency and marital status are related to the work-life balance. Gender, type of work, work schedule, and occupational health training were not statistically correlated with the work-life balance. Table 2: Factors positively correlated with work-life balance include Age (r = 0.219), family support (r = 0.312) work experience (r = 0.235) and social support (r = 0.248) while, number of hours worked (r = -0.399), role ambiguity (r = -0.375) and role conflict (r = -0.159) was negatively correlated with work-life balance of occupational health nurses.

Factors Predicting the Work-life Balance of occupational health nurses: According to the findings, age, income sufficiency, number of hours worked/week, role conflicts, role ambiguity, and family support were able to predict the work-life balance of professional nurses with statistical significance at 0.05. The co-prediction ability was equal to 37 percent (Table 3)
Table 2 Relationship between Independent Variables and work-life Balance

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Age</td>
<td>.219**</td>
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<td>Work Experience</td>
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<td>.458**</td>
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<td>Work hours</td>
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<td>-.152</td>
<td>-.276**</td>
<td>1</td>
<td></td>
<td></td>
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<td>Social support</td>
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<td>.002</td>
<td>.120</td>
<td>-.073</td>
<td>1</td>
<td></td>
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<tr>
<td>Role ambiguity</td>
<td>-.375**</td>
<td>-.063</td>
<td>-.198**</td>
<td>.058</td>
<td>-.460**</td>
<td>1</td>
<td></td>
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<tr>
<td>Role conflict</td>
<td>-.159*</td>
<td>-.085</td>
<td>-.046</td>
<td>-.071</td>
<td>-.145*</td>
<td>.108</td>
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<tr>
<td>Family support</td>
<td>.312**</td>
<td>-.089</td>
<td>.012</td>
<td>-.031</td>
<td>.357**</td>
<td>-.401**</td>
<td>.022</td>
<td>1</td>
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</tbody>
</table>

**p< .01 *p< .05

Table 3 Regression analysis of the work life balance of occupational health nurses

(Enter Method)

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Std. error</th>
<th>beta</th>
<th>t</th>
<th>p-value</th>
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<td>1. Age</td>
<td>0.197</td>
<td>0.67</td>
<td>0.158</td>
<td>2.945</td>
<td>&lt;0.001</td>
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<td>2. Income sufficiency</td>
<td>7.756</td>
<td>1.948</td>
<td>0.211</td>
<td>3.982</td>
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</tr>
<tr>
<td>3. Number of hours worked</td>
<td>-0.203</td>
<td>0.035</td>
<td>-0.313</td>
<td>-5.835</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>4. Role conflicts</td>
<td>-0.918</td>
<td>0.226</td>
<td>-0.237</td>
<td>-4.068</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>5. Role ambiguity</td>
<td>-0.271</td>
<td>0.110</td>
<td>-0.130</td>
<td>-2.455</td>
<td>0.015</td>
</tr>
<tr>
<td>6. Family support</td>
<td>0.217</td>
<td>0.063</td>
<td>0.198</td>
<td>3.419</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Constant = 117.615, SE = 8.444, R² = 0.386, R²-Adjust = 0.370, F = 23.615, p-value < 0.001

Discussion

The work-life balance of the occupational health nurses in this study was found to be moderate (M = 3.44, SD = 0.38). However, the above findings contradicted the findings of a previous study, which found the work-life balance of professional nurses in hospitals to be high (M = 3.59, SD = 0.44) because the study sample had different characteristics, work conditions, and work type. The occupational health nurses working in business facilities worked part-time and worked in more than one business facility. Consequently, the occupational health nurses working in business facilities had additional work hours in combination with the fact that the nurses were working with limited resources and diverse colleagues. The aforementioned factors might have made the work-life balance of the occupational health nurses working in business facilities lower than those working in the hospital. Nevertheless, that fact that the professional nurses working in business facilities had moderate work-life balance indicates that the nurses exerted effort to ward maintaining balance at an appropriate level, despite heavy workloads and hours, including different types of work and work roles than nurses working in hospitals. However, the occupational health nurses were able to give equal priority to work-related duties and family life. Because the nurses were able to have positive interactions with family members, they were able to mix family roles and overcome conflicts between different roles at work and in family life with good balance. If, however, occupational health nurses working in business facilities were in different circumstances from the past or were motivated to make changes, the occupational health nurses would be at risk for having either higher or lower levels of work-life balance.

When considered in terms of individual factors, work-life balance was found to be highly connected to
mental attachment (M = 3.58, SD = 0.52), which shows that occupational health nurses paid attention to every action performed, took responsibility for duties and dedicated strength and ability to work success. Thus, the nurses worked with love and organizational attachment. Hence, the balance in this area was high, while work-life balance for time and satisfaction balance were moderate (M = 3.43, SD= 0.57). The aforementioned findings might be explained by the shortage of occupational health nurses and economic needs for supplemental income. Thus, the nurses working in business facilities apart from their regular jobs spent more time at work where by excessive work hours and frequent over time shiftwork were key indicators of work-family conflicts. Apart from their need to take responsibility and dedicate themselves to their work, the nurses’ families were also important and could not be neglected. Therefore, the occupational health nurses had lower work-life balance in terms of time balance and satisfaction balance than involvement balance. The above finding contradicts the findings of a study conducted by Tannida Thipawatee who found work-life balance in terms of satisfaction balance and mental attachment to be high, while work-life in terms of time balance was moderate.

Personal factors, work factors and family factors were found to be correlated with the work-life balance of the nurses with statistical significance at p value < 0.05, which supports the hypothesis. Marital status and income sufficiency were found to be correlated with work-life balance (χ² = 16.492, χ² = 12.943), while age (r =0.219), family support (r = 0.312), work experience in business facilities (r = 0.203) and social support in the workplace (r = 0.248) were found to be positively correlated with work-life balance, while number of hours worked (r = -0.399), role ambiguity (r = -0.375) and role conflicts (r = -0.159) were found to be negative correlated with work-life balance, thereby demonstrating the importance of the aforementioned variables in terms of impact on work-life balance, particularly family support and added social support, which further increased work-life balance.

Personal factors, family factors and work factors can predict the work-life balance of professional nurses working in business facilities, which supports Hypothesis 2 in which age, number of hours worked, role conflicts, role ambiguity, income sufficiency and family support can co-predict work-life balance in professional nurses at 37.0 percent with statistical significance set at 0.05. Number of hours worked had the highest degree of predictive power, which demonstrates that number of hours worked plays a key role in work-family conflicts. Long numbers of hours worked can have negative effects on health condition. For example, the body and mind can become weak, while nurses have no time to relax or care for family members with additional impact in the form of attitudes and work-related errors. At the same time, increasing role ambiguity or role conflicts play a key role in work-family conflicts. Therefore, work satisfaction decreases and work-life balance is also likely to decline. On the contrary, receiving family support including both emotional support (love, attention from other people and resource support and easing various burdens) can contribute to smooth work and family life leading to good work-life balance. At the same time, older nurses have greater security in life in terms of work-related tasks and improved financial status leading to income sufficiency, which helps older nurses avoid extra work or a large amount of overtime. Thus, the number of hours worked decreases as time for self and family increase. Occupational health nurses working in business facilities, therefore, have good work-life balance. The findings of the present study demonstrate that the work-life balance of professional nurses working in business facilities is composed of the following three main factors: personal factors, work factors and family factors. Based on the aforementioned factors, the work-life balance of occupational health nurses working in business facilities can be improved by increasing or supporting the following factors: income sufficiency, family support and higher age, while factors such as number of hours worked, role ambiguity and role conflict should be reduced in relation to work.

**Conclusion**

Overall work-life balance of occupational health nurses in this study was at moderate level. Involvement balance was highest followed by satisfaction balance and time balance. The predictive factors for work-life balance were age, income sufficiency, number of hours worked, role conflict, role ambiguity and family support. Results suggest that these predictive factors should be applied to developing the programs for promoting work-life balance for occupational health nurses in Thailand.

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Ethical Clearance: The study protocol was approved by the Human Ethics Committee at Faculty of Public Health, Mahidol University, Thailand (COA. No. MUPH 2018-030). All participants gave their written informed consent.

Source of Funding: Self

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Characteristics of the Maternal and Child Health Service of Female Workers with Maternal and Child Health Status in Indonesia

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Abstract

Maternal and Child Health (MCH) service for female worker from before the pregnancy until the first day of a child’s life needs to be done because of so many risks that the worker will face. Accompaniment is done to determine the health condition of the worker and the health of the fetus (infant). The purpose of this study was to provide an overview about characteristics of the maternal and child health service of female workers with maternal and child health status in Indonesia.

The design of this study was observational descriptive. The study was conducted on female workers in industrial area with 500 respondents. This study variables were included marital status, age of first pregnancy, pregnancy examination, personnel who assisted the process of pregnancy check up until maternity process, the place of maternity, pregnancy disorder, miscarriage / abortus, exclusive breastfeeding and immunization.

Data collection techniques in the form of filling questionnaires either in direct interview or not. The results showed that 66.6% of female workers married at the age of 17-25 years. 67.2% were pregnant at the age of 20-27 years. 56.6% of female workers performed monthly pregnancy checkups. 67% of pregnancy checks performed by midwives. 43.05% stated that delivery was done at midwife’s home. 31.7% of female workers experienced pregnancy disorders. 47.7% of workers provided exclusive breastfeeding. 99% of workers have provided basic immunization. The Maternal and Child Health service that have been received are good enough but the health promotion and provision of MCH service should be done in the company.

Keywords: Female workers, Maternal and Child health, MCH status

Introduction

Both female and male workers are at risk to encounter stress. Baker¹ found that stress experienced by a person will change the way the immune system works. There are physical, chemical, biological, ergonomic, and psychosocial risks in the workplace. Those risks are harmful to women and their fetuses, especially chemical hazards. Chemical and radiation can cause disability occurrence in newborn infant, low birth weight incidence, fetal death (infant death), and the incidence of recurrent abortion. If the company can preempt, then the occurrence of these risks due to the hazards in the workplace can be minimized.

Unconsciously, female workers have made a natural neglect of their babies and children. The child is left at home because the mother is working to help the economic condition of the family. This happens usually in urban migrants who do not think too much about their nutritional status. Based on data from the Health Office of Sidoarjo district in 2016, the number of exclusively

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breastfeeding infant is still low. From 5,602 infants who were examined, only 54.7% received exclusive breastfeeding.

It is necessary to provide accompaniment to the female worker from before the pregnancy until the first thousand days of a child’s life because of the many risks that will be experienced by the mother in those times. Accompaniment is done to determine the health condition of the worker and the fetus (infant). Therefore, a study was conducted to identify problems in female workers to rescue the first 1000 days of life and to make recommendation based on the diagnosis of the problem in order to save the first thousand days of life in formal sector female workers in Sidoarjo district. The aim of this study was to provide an overview of Characteristics of MCH service female workers with MCH status in Indonesia.

**Material and Method**

The design of this study was observational descriptive. The study was conducted on female workers in Sidoarjo industrial area, Indonesia. The data were collected from September to November 2017. This study respondents were 500 people with inclusion criteria for female workers who have worked for more than a year. In the study process there were several female workers who withdrew from the study for some reason so that the number of samples decreased into 439. Variable studied were MCH service and MCH status. The variables include: marital status, age of first pregnancy, pregnancy examination, personnel who assist the process of the pregnancy check up until the maternity process, the place of maternity, pregnancy disorder, miscarriage, exclusive breastfeeding and immunization, Data collection techniques in the form of filling questionnaires either in direct interview or not. Analytical method used descriptive analysis with the help of data analysis software.

**Result**

This study focused on female laborers working in Sidoarjo, Indonesia. The description of MCH service and labor status characteristics. Attempts to know the service and status of MCH are important to predict and improve the status of 1000 DOF (day one of life). This period is important for mother’s health and baby’s growth which will be one of the most important growth periods of her life.

1. Marital age

Marital age becomes one of the important things associated with mother readiness to be pregnant and give birth. The results showed that 66.6% of female workers married at the age of 17-25 years. Most of them married at a good age to give birth. However there were 5% married at the age of less than 17 years and 2.1% married at the age of more than 35 years.

Young marriage age can lead to many healths and psychological problems. A marriage at an early age raises many complications during the pregnancy process and ultimately can cause maternal and infant deaths. In addition, young marriage also affects the psychological process which less good for the mother and child. Young marriage age can also increases the incidence of unplanned pregnancy, repetition of pregnancy less than 24 months and the occurrence of miscarriage.

Early marriage will also has an impact on child growth after birth. Nutritional problems such as diarrhea, malnutrition and other developing diseases. Other MCH problems that can occur include STD (sexually transmitted diseases), cervical cancer, maternal death and obstetric fistulas.

2. Pregnancy

95% of female workers claimed to have been pregnant. The majority of 41.2% had been pregnant twice so far. However, there were 3.6% who got pregnant four times and there were respondents who stated that had been pregnant 5-7 times. Having more than two children will have an impact to the economic burden of the family that indirectly results in the fulfillment of nutrition for the child growth. In addition, high frequency of childbirth also has a strong relationship with the incidence of cervical cancer. So that female workers who have high delivery frequency are advised to do paps smear.

3. Age of First Pregnancy

67.2% were pregnant at the age of 20-27 years old. However, 2.7% were pregnant at less than 17 years of age and 3.5% were pregnant for the first time at the age over 35 years old.

Age of pregnancy can also affect the health of the mother and child. Pregnancy at an early age can causes various diseases such as diarrhea, malnutrition, pregnancy disorders, cervical cancer. Then pregnancy at the age of the tuga can cause health problems...
hypospadias. Study in California showed that the mother who delivers at the age over 35 years old for the first time, will be at risk for hypospadias.6

4. Pregnancy Examination

Pregnancy examination is one of the important things to do for the mother and child health during pregnancy. 56.6% of female workers were performed a monthly pregnancy check, but 1.8% stated that only examined thrice during pregnancy.

Pregnancy examination is strongly associated with maternal health and antenatal care which is acceptable during pregnancy.7 Routinely pregnancy examination can better monitor the health of the mother and baby. Routinely examination prevents the disorder during pregnancy and it can help the birth process becomes safe. Pregnancy examination visit is also influenced by the attitude and affordability of the examination place.8 Pregnancy examination can be improved either by passing a MCH program in a company such as providing a doctor or midwife who can periodically comes to the company and conducts health promotion to female workers about the importance of pregnancy examination regularly.

5. Medical or Paramedic Personnel who Performs Pregnancy Examination

67% of female workers stated that pregnancy examination was done by midwife, 18% was done by obstetrician. It is interesting that there was still 1% who did pregnancy examination in a shaman.

The right examiner is certainly a doctor or midwife. Because they have good skill and knowledge which are related to pregnancy and the process of labor. The worker who still checks into a shaman certainly needs to be the one of the attention. One of the classic reasons for choosing a shaman is because of the location closeness and low cost9.

This study was conducted in Sidoarjo with easy access to health services so the importance of choosing a competent medical or paramedic personnel to do pregnancy examination is needed.

6. The Place of Maternity

Maternity place can also affects the process and continuity of the baby’s birth associated with the tools and materials needed during the childbirth. 43.05% stated that delivery was done at midwife’s house, 30% was done in hospital. The results showed that there were 2.5% still given birth at home and there were 0.5% at a shaman house.

7. The Personnel who Helps Maternity

The personnel who helps the delivery will also determines whether the delivery process is going well. The results showed that 63.3% percent of births were assisted by midwife, 34.3% were assisted by doctor and there were 2.3% or 9 people who stated that the birth process was assisted by a shaman.

The place of maternity with its personnel who assisted the delivery process is already favorable in general, either assisted by an obstetrician or midwife. But there are still a number who assisted by a shaman. The selection of shaman can be influenced by cultural factor, lack of knowledge and access to health services.10 A shaman selection is certainly one of the factors that can lead to maternal or infant deaths. Thus, it is necessary to promote MCH at the company or at an integrated health post (posyandu) to inform that the delivery process should be done in hospital, midwife’s house, or other maternity place which is favorable and assisted by competent medical or paramedic personnel. This effort is essential to prevent maternal and child mortality.

8. Pregnancy Disorder

31.7% of female workers who become respondents stated that they had a pregnancy disorder. The disorders include nausea, vomiting, high blood pressure, seizure, and bleeding.

Pregnancy disorder may be caused by age during pregnancy of less than 20 years old and over 35 years old, the examination is not assisted by medical personnel and not performed in a health facility, history of pregnancy disorder in previous pregnancy and occurring in high-risk women.11 Based on the data that has been submitted we know that some people who are pregnant at the age of less than 17 years old and more than 35 years old, examine their pregnancy to a shaman. This certainly leads to disruption or complication of pregnancy which can occur in female workers.

9. Miscarriage and Infant Mortality

14 respondents said that they had experienced a
miscarriage during pregnancy. 95.7% of miscarriages occurred at the age of 0-3 months. Among all of miscarriage cases, 81.8% had one miscarriage and 16.6% had two miscarriages.

Miscarriage and infant mortality can be caused by the age during pregnancy which is too young, the examination is not done by medical personnel routinely, the delivery process is done at home or at a shaman home, and can be caused by various hazards existing in the work environment. It is certainly necessary to do MCH promotion in the work environment, to perform hazard control in the workplace and to raise an awareness of working mother and their family about maternal and child health.1, 2, 10, 11

10. Exclusive Breastfeeding

47.7% of female workers provided exclusive breastfeeding while the rest do not gave exclusive breastfeeding. There are various reasons i.e. the milk doesn’t come out (43.1%) and busy working (46%). Exclusive breastfeeding is very important to the growth of toddlers. During the 6 months toddler should only consume exclusive breastfeeding.2,11 Exclusive breastfeeding is important for the child’s motoric growth, provide immunity to the disease, provide the nutritional intake required by infant and emphasizing the emotional bond between the baby and the mother.13

11. Basic Immunization

99% of workers claimed to provide complete basic immunization through integrated health post / posyandu program.14 Full immunization has been provided by the female workers for their child. Immunization is important to provide immunity to diseases that can be prevented by immunization. In addition, immunization is also important to prevent outbreak. Immunization is important to maintain the health and growth of children.

In general, health promotion efforts should be done about the importance of MCH to female workers. The company is also advised to provide MCH services toward pregnant workers. Such services may include the provision of a doctor or midwife who can periodically come to the workplace to examine the womb and provide health education, promotion of MCH health. A lactation corner is needed in the company to support exclusive breastfeeding. Cooperation of the company with local health authority is also required to provide favorable and qualified MCH services.

**Conclusion**

In general, the marriage age of female workers is good, but there are some workers who married at the age of less than 17 years old and more than 35 years old. This age is related to the first pregnancy age. This can causes pregnancy disorder until the delivery process.

In general, pregnancy examination have been routinely performed by the female workers and performed by medical personnel who has competence, but there were still a few who do not check pregnancy routinely and there were even still using a shaman service.

Selection of maternity and labor place which helps the delivery process is well done. But there were some people who are still given birth at a shaman. This needs to be overcome to maintain the mother and child health.

There was an incidence of miscarriage and infant mortality, this is related to the first age of pregnancy, less routinely pregnancy examination, and pregnancy examination that are not assisted by paramedic / medical personnel.

Some female workers had not given exclusive breastfeeding because of the busy work and the milk won’t come out. MCH health promotion should be done in the workplace so the mother will know the importance of exclusive breastfeeding.

The immunization had been well done

There should be an effort to promote MCH services in the workplace so that a worker who is or will be pregnant knows the importance of maternal and child health attempts.

The company should provide MCH program by bringing a doctor or midwife who regularly come to the company every month to conduct health checks of pregnant and lactating mother if possible.

**Conflict of Interest:** None

**Source of Funding:** Ministry Of Health Republic Indonesia and Department of Occupational Health and Safety, Public Health Faculty, Airlangga University, Surabaya, Indonesia
**Ethical Clearance:** The research proposal has been approved by Health Research Ethical Commission of Public Health Faculty Airlangga University.

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Analysis of Work Related and Non-Work Related Factors Relationship with Fatigue among Stamping Workers in Automotive Industry

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Abstract

Work related fatigue is a significant hazard in many industrial sectors for the impact it caused to workers’ ability to do their jobs safely. Workers in manufacture sector, which often applies 24-hour production system, are at risk for work related fatigue. This study aimed to review manufacturing workers’ fatigue level and analyze factors that may influence it. Cross-sectional was used as a design study to determine the relationship between the independent and dependent variables investigated in this study. Sample of this study were 110 workers from production department in PT. XYZ Stamping Plant. Data collecting was done subjectively by using questionaire. Workers’ fatigue level was rated by Subjective Self Rating Test from IFRC, sleep quantity and quality by Pittsburgh Sleep Quality Index, and NASA Task Load Index was used to rate workload. Meanwhile, noise level used were from the company’s secondary data. The result showed that 47,3% of total 110 repondents were experiencing fatigue in the last week and it was related significantly to their work duration, workload, sleep quantity and quality.

Keywords: Fatigue, workers, automotive industry

Introduction

Work fatigue is a significant hazard in various industrial sectors because of its impact which affects the ability of workers’ to do their jobs safely. Fatigue is often identified as a contributing factor to accidents, injuries and workplace deaths, with the implication that people who are exhausted tend to work unsafe. Worker fatigue has been shown to increase the risk of accidents at work, increase the number of errors in work, reduce worker productivity, and cause material losses due to decreased worker productivity and costs incurred for health services.

A meta-analysis estimates that up to 13% of workplace injuries are related to fatigue. As much as 38% of the workforce in the United States experienced fatigue and this caused a loss of more than 60 million USD related to loss of productivity, work accidents, and the cost of health services each year. A survey of fatigue among manufacturing workers in the United States found that around 57.9% of respondents experienced fatigue with the most frequent causes of sleep deprivation, work stress and their work shift schedules. High fatigue prevalence was also found in workers at a stamping plant of a large car component manufacturer in Indonesia.

In multidimensional aspect, fatigue can be defined as a state neuropsychophysiologic that occurs in people who feel tired or sleepy, reducing the capacity to function, resulting in decreased performance, negative emotions and boredom. Grandjean on Fatigue in Industry describe fatigue in a container degree of fatigue. The degree of exhaustion is an accumulation of all the different stress received by a person throughout the day. The most common fatigue causes are sleep deprivation, disruption of circadian rhythms, and the length of time spent on a job. Based on previous researches, the causes of fatigue can be identified as work-related causes, such as...
as work duration\textsuperscript{12}, shift work system\textsuperscript{13,14}, workload\textsuperscript{15}, physical and psychosocial environment at work\textsuperscript{15,16}, work stress\textsuperscript{17}, etc. Non work-related causes, such as duration and quality of sleep\textsuperscript{11}, demographic characteristics\textsuperscript{18}, health problems\textsuperscript{19}, family conflict\textsuperscript{20}, commuting time\textsuperscript{21}, lifestyle\textsuperscript{22}, etc.

Indonesia’s automotive manufacturing industry is the second largest in ASEAN after Thailand. Production of the automotive industry in Indonesia since 2009 has increased by more than double. Along with the development of demand and consumer preferences, manufacturers compete to increase production with high efficiency. One of the strategy is the implementation of production 24 hours a day. To perform a 24-hour production, companies divide their employees into several shifts, as well as implementing overtime to reduce costs for additional employees\textsuperscript{23}. However, such system may have consequences, like the occurrence of fatigue in workers. This research was conducted with the aim to describe the level of subjective fatigue and the contributing factors among stamping workers.

**Method**

This is an epidemiological descriptive cross-sectional study with quantitative approach to identify and analyze the factors related to the stamping workers’ fatigue. The study was conducted in May 2018 on all employees working as an operator in the production department of stamping plant owned by PT. XYZ, which were about 344 people. PT. XYZ is one of the major companies engaged in the field of automotive manufacturing in Indonesia. The minimum sample required were 78 workers, however to anticipate the incompleteness of data the number of samples increased to 120. Sample was randomized proportionally on each shift and work section groups exist; day and night shift; pressing, welding, and supporting section.

All respondents who agreed to participate signed the informed consent. Data collecting was done through questionnaire that was submitted to the safety officers in each work group. A sheet of questionnaire consisted of 30 questions of subjective self rating test instruments to measure workers’ fatigue level in the past 4 weeks with 5 point Likert scale, Pittsburgh Sleep Quality Index (PSQI) to assess sleep duration and subjective sleep quality in a time interval of one month, NASA - Task Load Index to measure workload, as well as several question items to measure other primary data such as workers’ age, length of employment, nutritional status, marital status, work shift, work duration, and commuting time, and side activities.

Collected data were entered to and analyzed by statistical software IBM SPSS 20. Univariate analysis was conducted to see the distribution and frequency of each variable studied. To study the relationship between the causes of fatigue, which includes factors related to work (length of employment, work shift, work duration, workload, noise level) and factors not related to work (age, marital status, nutritional status, sleep quantity, sleep quality, side activities, commuting time) with workers’ fatigue, we used Chi Square test and Independent T-test with significance level 5%, i.e, $p < 0.05$.

**Result**

**Socio-demographic Characteristics**

From the total of 120 questionnaires that were distributed, 116 were returned. However, only 110 questionnaires were valid and could be analyzed. The respondents were all male and have education level of high school or the equivalents. Overview of the socio-demographic characteristics of respondents presented in Table 1.

<table>
<thead>
<tr>
<th>Tabel 1 Socio-demographic Characteristic of Respondents (n =110)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variables</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Age (year)</td>
</tr>
<tr>
<td>18 – 25</td>
</tr>
<tr>
<td>26 – 33</td>
</tr>
<tr>
<td>34 – 41</td>
</tr>
<tr>
<td>42 – 49</td>
</tr>
<tr>
<td>Marital status</td>
</tr>
</tbody>
</table>
### Table 1: Socio-demographic Characteristic of Respondents (n = 110)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>47.3</td>
<td>52.7</td>
<td></td>
</tr>
<tr>
<td>Nutritional status (BMI)</td>
<td>22.78</td>
<td>3.55</td>
<td></td>
</tr>
<tr>
<td>Underweight (BMI &lt; 18.50)</td>
<td>5.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal (BMI 18.50 – 25.00)</td>
<td>64.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight (BMI 25.01 – 27.00)</td>
<td>16.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severely overweight (BMI &gt; 27.00)</td>
<td>13.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work experiences (year)</td>
<td>6</td>
<td>6.37</td>
<td>59.1</td>
</tr>
<tr>
<td>0 – 5</td>
<td></td>
<td></td>
<td>13.6</td>
</tr>
<tr>
<td>6 – 11</td>
<td></td>
<td></td>
<td>23.6</td>
</tr>
<tr>
<td>12 – 17</td>
<td></td>
<td></td>
<td>3.60</td>
</tr>
<tr>
<td>18 – 23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work section</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressing</td>
<td></td>
<td>54.5</td>
<td></td>
</tr>
<tr>
<td>Welding</td>
<td></td>
<td>23.6</td>
<td></td>
</tr>
<tr>
<td>Supporting</td>
<td></td>
<td>21.8</td>
<td></td>
</tr>
</tbody>
</table>

The average age of respondents was 26 years (med = 23 years), ranging from 18-47 years, with the most frequent age group was 18 to 25 years old. Only 47.3% of respondents was married. As for nutritional status, most of them had normal BMI (64.5%). Most of the respondents had been working for 5 years, with mean 6 years (med = 2 years).

### Fatigue Prevalence

The results of subjective fatigue measurements performed on respondents showed that there were 47.3% respondents who feel fatigued in the past 4 weeks. The average fatigue score is 25.95 (SD = 13.11), ranging from 4 to 82. Section with the most fatigued workers is Welding (65.38%). Respondent fatigue prevalence presented in Table 2.

### Table 2: Fatigue Prevalence by Work Section (n = 110)

<table>
<thead>
<tr>
<th>No</th>
<th>Work section</th>
<th>Fatigue</th>
<th>Not fatigue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>f</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>Pressing</td>
<td>26</td>
<td>43.3</td>
</tr>
<tr>
<td>2</td>
<td>Welding</td>
<td>17</td>
<td>65.4</td>
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<tr>
<td>3</td>
<td>Supporting</td>
<td>9</td>
<td>37.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>52</td>
<td>47.3</td>
</tr>
</tbody>
</table>

### Causes of Fatigue

The majority of respondents work more than 40 hours a week and have a moderate-high level of workload. In the non-work factors also found that most of the respondents sleep less than 7 hours a day and had poor sleep quality. Distribution of respondents based on the characteristics of work and non-work presented in Table 3.
Tabel 3 Distribution of Respondents by Work And Non-Work Related Characteristics (n = 110)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work related characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shift</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day</td>
<td>50,9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Night</td>
<td>49,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work duration (hours/week)</td>
<td>53,71</td>
<td>6,97</td>
<td></td>
</tr>
<tr>
<td>Normal (≤ 40)</td>
<td>1,80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long (&gt; 40)</td>
<td>98,2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workload</td>
<td>73,84</td>
<td>12,31</td>
<td></td>
</tr>
<tr>
<td>Low (score &lt;50)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate (score 50 – 80)</td>
<td>76,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High (score &gt; 80)</td>
<td>23,6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise level (dBA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 85</td>
<td>35,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 85</td>
<td>64,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-work related characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep duration (hours/day)</td>
<td>6,06</td>
<td>0,99</td>
<td></td>
</tr>
<tr>
<td>&lt; 7</td>
<td>65,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 7</td>
<td>34,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep quality</td>
<td>6,99</td>
<td>2,061</td>
<td></td>
</tr>
<tr>
<td>Good (score ≤ 5 )</td>
<td>28,2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bad (score &gt; 5)</td>
<td>71,8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commuting Time (minutes)</td>
<td>33,23</td>
<td>31,28</td>
<td></td>
</tr>
<tr>
<td>≤ 30</td>
<td>68,2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 30</td>
<td>31,8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On foot, bike</td>
<td>35,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car, Motorcycle</td>
<td>63,6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public transport</td>
<td>0,90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>49,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>50,9</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second job, college, doing house chores</td>
<td>3,30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hobbies (sports)</td>
<td>61,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etc</td>
<td>5,60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variables which have statistically significant correlation with level of fatigue were work duration (p = 0,001), workload (p = 0,05), sleep duration (0,001) and sleep quality (0,001). Respondents who worked more than 40 hours per week and has high workload, had higher risk to experienced fatigue. The same higher risk was also found in group of respondents who slept less than 7 hours per day, had bad sleep quality. Thus t-test results showed that the fatigued respondent group naturally had longer work duration, higher workload, lesser sleep duration and worse sleep quality score. The relationship between risk factors and fatigue levels presented in Table 4.
<table>
<thead>
<tr>
<th>Socio-demographics and non work factors</th>
<th>Work related factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>p-value</td>
</tr>
<tr>
<td>Age</td>
<td>&gt; 23 years</td>
</tr>
<tr>
<td></td>
<td>≤ 23 years</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
</tr>
<tr>
<td></td>
<td>Not Married</td>
</tr>
<tr>
<td>Nutritional status</td>
<td>Abnormal</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
</tr>
<tr>
<td>Sleep duration</td>
<td>&lt; 7 hr/day</td>
</tr>
<tr>
<td></td>
<td>≥ 7 hr/day</td>
</tr>
<tr>
<td>Sleep quality</td>
<td>Bad</td>
</tr>
<tr>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>Commuting time</td>
<td>&gt; 30 mnt</td>
</tr>
<tr>
<td></td>
<td>≤ 30 mnt</td>
</tr>
<tr>
<td>Side activities</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

**Discussion**

The study identified that almost half (47.3%) of the stamping operators experienced fatigue in the past 4 weeks. The fatigue said workers experienced are statistically associated to their work duration, workload, sleep duration and quality. Section with the most fatigued workers is Welding (65.38%). This could be explained by the workload on the Welding section that was the highest among other sections. Not only lots of physical work (ie, materials lifting and moving, welding spot gun using, etc), but also psychological demand involved so that spot welding can be done accurately.

Statistical test results showed that workers who experience fatigue tends to have longer duration of work.
compared to workers who are not fatigued. These results are in line with Lu who stated that workers with long work duration have a greater risk of fatigue than those with less than 40 hours a week, because the longer a person doing a job, the greater the need for recovery, but their chances of getting the recovery is diminishing with the increasing duration of work\textsuperscript{24,7}. Significant relationships were also found between workload and fatigue, where workers who have high levels of workload are at greater risk for experiencing fatigue compared with workers who don’t. These results are consistent with research that states that the workload affects of fatigue in workers, and associated with a lack of energy, physical effort, physical discomfort, lack of motivation and sleepiness\textsuperscript{25}. It occurs because a job with higher workload, naturally requires more energy to be done\textsuperscript{26}.

Non related work factors, such as the workers’ sleep and quality are significantly related to fatigue. Workers who experienced fatigue tend to have lesser sleep duration. The average PSQI score of the workers who experienced fatigue was also significantly higher when compared with the workers who didn’t. This means that workers who experienced fatigue tend to have poorer sleep quality. These results are consistent with the Lu’s finding (2017), where the lack of sleep is the most common causes of fatigue. Lack of sleep (< 7 hours per day) was significantly associated with fatigue, because the workers will get less recovery. A person who has poor sleep quality too, can be mentally and physically fatigued when working\textsuperscript{11}. Workers’ sleep quality can be affected by various factors, such as stress, emotional state, lack of social support, high workload, health, and also the living conditions of workers\textsuperscript{13}.

There are some limitations to this study. The cross-sectional design used cannot establish cause and effect, the data collecting that was only done subjectively, also other fatigue causes that probably has bigger influence were not included in this study.

**Conclusion**

The percentage of stamping workers who experienced fatigue is 47.3%, while 52.7% do not experience fatigue. There are statistically significant relationships between duration of work, workload, quantity of sleep and the quality of sleep with the level of worker fatigue. Other variable factors and more advanced methods might be needed for the future researches.

**Ethical Clearance:** This study was approved by the Ethic Review Board of the Faculty of Public Health Universitas Indonesia No. 339/UN2.F10/PPM.00.02/2018.

**Conflict of Interest:** The authors declare there is no conflict of interest.

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