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CONTENTS

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A Study of Pulmonary Function Test in Type II Diabetes Mellitus – Spirometry Based

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ABSTRACT

Diabetes is one of the most common non-communicable diseases worldwide. The prevalence of type II diabetes is increasing in developing countries like India. Due to the presence of an abundant connective tissue and an extensive micro vascular circulation raises the possibility that lung may be a target organ in diabetic patients. The aim of the study was to compare the Lung function in type II Diabetics with healthy subjects and to correlate the lung function parameters with duration of diabetes mellitus. This case control study was conducted in 40 type II diabetics with duration more than 2 years and 40 healthy controls of age group 35–55 yrs. PFT was done by using computerized spirometer. Parameters like FEV_1, FVC, FEV_1/FVC%, MVV, PEFR & $FEF_{25-75\%}$ are recorded. Statistical analysis was done by using student's 't' test and Pearson's correlation coefficient. The pulmonary function parameters like FEV1%, FVC% and PEFR were significantly reduced in type II diabetics when compared with healthy controls, whereas FEV_1/FVC% was not reduced significantly. This showed a restrictive pattern of pulmonary impairment in type II diabetics and as the duration of diabetes increases the restrictive lung impairment becomes more prominent. As spirometry is much more reliable, valid and simple test, the diabetics are suggested to undergo pulmonary function testing periodically.

Keywords: Diabetes mellitus, Pulmonary function test, PEFR, FVC, FEV_1, MVV.

INTRODUCTION

Diabetes is renowned as a silent epidemic due to the slow progression and lack of symptoms in the early stages of disease [1]. According to WHO survey, India will be the world diabetic capital in 2025. The prevalence of diabetes is increasing, with type II diabetes accounting for 90 – 95% of all cases [2].

The etiogenesis of type II diabetes reflects the heterogeneous genetic, pathologic, environmental and metabolic abnormalities that can exist in different patients and all lead to a final common pathway of hyperglycemia [3]. Chronic hyperglycemia is associated with continuing damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart, lungs and blood vessels [4].

The pathogenesis is thought to involve both a microangiopathic process and non enzymatic glycosylation of tissue proteins. This process results in impaired collagen and elastin cross-linkage with a reduction in strength and elasticity of connective tissue[5]. These micro-vascular complications appear early within 5 to 10 yrs and macro-vascular complications appear within 15 to 20 yrs from the onset of diabetes [6].

Although there are several clinical studies in type I diabetes evidenced that lung function is reduced due to decreased elastic recoil, diminished respiratory muscle performance, decrease in pulmonary diffusion capacity for carbon monoxide [7].

As the prevalence of type II Diabetic Mellitus is increasing in our population, it is utmost important to

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investigate whether these lung function changes occur in type II diabetics even with good glycemic control. Thus, this study was under taken to correlate the lung function in type II diabetes with duration of diabetes and to find out whether it is obstructive or restrictive pattern.

AIMS & OBJECTIVES

To assess the lung function in type II diabetic patients.

To correlate pulmonary function parameters with duration of type II diabetes mellitus.

MATERIALS AND METHOD

This case-control study was done in the department of physiology, Thanjavur Medical College during 2011-2012. Institutional ethical committee approval was obtained. An informed written consent was obtained from all the participants. Detailed history and thorough clinical examination was carried out.

Anthropometric measurements like height, weight were measured and BMI was calculated. Glycemic status was measured by doing fasting & post prandial blood sugar. HbA1c was determined by turbidimetric immunoassay and value less than 7% was taken for study.

The control group comprises of 40 healthy volunteers were randomly recruited from the general population residing around Thanjavur Medical College. The diabetic group comprised of 40 type II diabetic patients on oral hypoglycemic drugs from the diabetic outpatient department of age group 35 – 55yrs with duration of diabetes more than 2 yrs. They were inturn divided into two groups based on the duration of diabetes as 2-5yrs and 6-10yrs.

Subjects with hypertension, smoking, recent surgery, recent respiratory infection, occupational exposure and with cardiac /respiratory disease were excluded from the study.

Pulmonary function tests were done using computerized spirometer which was standardized according to American Thoracic Society performance criteria [Spiro Excel – Medicaid systems].

The Pulmonary function test was performed 3 times on the same day in sitting posture with two minutes interval and the best of the three was taken. The PFT parameters like forced vital capacity (FVC), FEV_1, $FVC/FEV_1\%$, PEFR, slow vital capacity (SVC) and maximum voluntary ventilation (MVV) were recorded. The % predicted values of above PFT parameters were computed for comparison.

STATISTICAL ANALYSIS

Pulmonary function parameters were analyzed by using SPSS 18.0. The PFT parameters of the diabetics were compared with healthy controls using Independent Student's t test and correlation was done by using Pearson's correlation coefficient test. $P < 0.05$ was taken as statistically significant.

RESULTS

Of the 80 participants, 40 were type II diabetics forming the study group and the remaining 40 were healthy subjects forming the control group. The diabetics were divided into 2 subgroups based on the duration of diabetes as 2-5 years and 6-10 years.

TABLE I: Anthropometric parameters of subjects of Control and Diabetic groups

	Control (n=40)	Diabetics (n=40)
	Mean ± S.D	Mean ± S.D
Age(years)	40.47±5.630	47.50±5.724
Height(cms)	162.38±3.814	162.75±3.111
Weight(kg)	61.68±11.796	60.03±9.588
BMI(kg/m²)	23.34±4.087	22.60±3.167
HbA1c%	3.1607±0.483	5.38±1.174

Table I shows that the subjects with good glycemic control are selected for the study.

Table II: Comparison of pulmonary function tests parameters between the controls and type II DM

PARAMETER (Predicted %)	Control group (n =40)	Diabetic group (n = 40)	P value
FE_V1	91.40±11.236	81.15±16.523	0.002*
FVC	81.85±9.211	73.75±13.933	0.003*
FEV_1/FVC%	117.05±7.250	116.58±7.071	0.768
PEFR	98.85±21.996	85.95±24.045	0.014*
$FEF_{25-75\%}$	136.73±26.056	125.63±41.009	0.152
MVV	65.20±15.010	58.80±16.530	0.074

Table II The mean (±SD) of FEV_1 (P = 0.002) , FVC (P=0.003) and PEFR (P==0.014)was found to be significantly reduced in diabetic group when compared to controls.

TABLE III: Comparison of pulmonary function parameter based on duration of diabetes mellitus between 2-5 years.

Parameters (predicted%)	Control Group (n=40) Mean ± SD	Diabetic group (n=26) Mean ± SD	P value
FEV_1	91.40±11.236	86.46±15.73	0.18
FVC	81.85±9.211	78.23±12.99	0.19
FEV_1/FVC%	117.05±7.250	117.62±6.25	0.75
PEFR	98.85±21.996	91.65±18.36	0.17
$FEF_{25-75\%}$	136.73±26.056	135.08±39.84	0.84
MVV	65.20±15.010	63.88±15.35	0.73

This table shows the mean values of FEV_1, FVC, PEFR, MVV are reduced but not statistically significant.

TABLE IV - Comparison of pulmonary function parameter based on duration of diabetes mellitus between 6-10 years.

Parameters (predicted%)	Control Group (n=40) Mean ± SD	Diabetic Group (n=14) Mean ± SD	P value
FEV_1	91.40±11.236	71.28±12.29	< 0.001*
FVC	81.85±9.211	65.428±10.97	< 0.001*
FEV_1/FVC %	117.05±7.250	114.64±7.80	0.30
PEFR	98.85±21.996	75.35±28.49	0.003*
$FEF_{25-75\%}$	136.73±26.056	108.07±35.54	0.003*
MVV	65.20±15.010	49.36±13.66	0.001*

This table shows that the mean (±SD) of FEV_1, FVC and MVV of diabetics with duration for 6-10years showed a highly significant reduction (P = 0.001) when compared with the control group.

TABLE V: Correlation between duration of diabetes and the parameters of lung function

Parameter (predicted %)	Pearson correlation	P value - sig (2 tailed)	
FEV$_1$	-0.0368	0.022	S
FVC	-0.3478	0.028	S
FEV$_1$/FVC	-0.1301	0.423	NS
PEFR	-0.3055	0.055	NS
FEF$_{25-75\%}$	-0.2935	0.066	NS
MVV	-0.4843	0.001	S

The lung function parameters FEV$_1$, FVC and MVV showed a significant negative correlation with the duration of diabetes whereas FEV$_1$/FVC %, PEFR, FEF$_{25-75\%}$ showed negative correlation but not significantly.

DISCUSSION

Type II diabetes mellitus is a heterogeneous constellation of disease syndromes, due to impaired insulin secretion, insulin resistance and increased hepatic glucose production and all these leads to a final common pathway of hyperglycemia[3].

Hyperglycemia causes pulmonary microangiopathy and glycosylation of proteins such as collagen in the lungs and chest wall. Impaired collagen and elastin cross-linkage increases lung stiffness and results in decreased elastic recoil, decreased chest wall compliance and muscular weakness [8]. Post-mortem studies on diabetic patients have shown the thickening of alveolar epithelial and pulmonary capillary basal laminae, centrilobular emphysema and pulmonary angiopathy [9].

Spirometry is a powerful tool that can be used to detect, differentiate and also to manage patients with pulmonary disorders. It is also useful to quantify the physiological reserves that are not clinically affected by diabetes [5].

In this study, the pulmonary function of type II diabetic patients was evaluated and to find out the correlation with duration of diabetic mellitus. In the present study, subjects with good glycemic control were selected for the study. HbA1c is relatively short term marker of glycemic control, a duration which may not impact an effect on lung function [10]. But the duration of glycemic exposure is more important than its magnitude [11].

Effect of type II diabetes onFEV$_1$and FVC:

In the present study the values of FEV$_1$and FVC were significantly reduced in type II diabetic patients when compared to healthy controls. These findings were consistent with T.M.E Davis et al [11] and Davis et al [12] study.

In normal healthy non smokers after the age of 35 years, the expected decline in lung function (FEV$_1$) is 25-30 ml/yr, whereas in diabetics, the decline is 71 ml/yr.

The reduced FVC was due to increase in the cross-linkage formation between polypeptides of collagen in pulmonary connective tissue [13]. Thus adults with impaired FVC and FEV$_1$ deserve high attention as an emerging novel risk factor for type II diabetes [14].

Effect of type II diabetes onFEV$_1$/ FVC%:

FEV$_1$/FVC ratio is a more sensitive indicator of airway obstruction than FVC or FEV$_1$ alone. In the present study, the FEV$_1$/FVC ratio (%predicted) did not show any significant change in diabetics when compared with controls. This shows restrictive type of pulmonary impairment as evidenced by significant reduction in FEV$_1$, FVC and normal FEV$_1$/FVC ratio. Similar results were observed with Agarwal et al [15], and Nakajima et al [16] in their cross-sectional study [10].

Our findings were consistent with Wannamethee et al [17] and Heianza et al [18]. The possible explanations would be hypoxia induced insulin resistance, chronic inflammation, traditional and metabolic risk factors or by obesity.

But Gupta et al [19] and Sreeja et al [20] observed obstructive pattern of lung dysfunction and it may be early change or subclinical.

Effect of type II diabetes on PEFR:

In this study, the PEFR values were reduced significantly in diabetics (P value - 0.014) when compared with non-diabetics. The possible explanation is the decrease in the force generating capacity of the expiratory muscle and the reduced elastic recoiling of the lungs. These findings were consistent with findings of Davis et al [12] and Agarwal et al [15] study.

Effect of type II diabetes on FEV$_{25-75\%}$:

FEF$_{25-75\%}$ indicates patency of the small airways. In this study FEF$_{25-75\%}$ values were reduced among diabetics when compared to non-diabetics but not significantly. This is due to increased amounts of collagen and elastin in basal lamina of alveolar wall [21]. Sreeja et al [20] observed significant reduction in FEF$_{25-75\%}$ and stated that this reduction is due to a lower airway caliber and high airway resistance.

Effect of type II diabetes on MVV:

In the present study the mean MVV values were lower in diabetics than controls but not significantly. Maximum voluntary ventilation is decreased due to poor respiratory muscle strength as a result of increased protein catabolism. A study conducted by Meo et al [21] and Keerthi et al [13] showed similar results.

Effect of duration of diabetes on lung function:

In the present study, there was no significant reduction in PFT parameters of diabetic subjects of duration 2-5 years when compared with controls. But there was a significant reduction in FEV$_1$, FVC, FEF$_{25-75\%}$, PEFR and MVV of diabetics of duration 6-10years when compared with non-diabetics. Whereas no significant change was observed in FEV$_1$/FVC % of diabetics of 6-10 years duration shows a restrictive type of pulmonary impairment.

Similarly Meo et al [21] observed restrictive pattern of airway disease in type II diabetics when the duration of diabetes is longer than 10years. As the duration of diabetes increases the inflammatory process also increases leading to progressive decrease in lung function [10].

Correlation of duration of diabetes with pulmonary function

In our study lung function parameters were negatively correlated with the duration of diabetes mellitus. FEV$_1$ (r = - 0.0368), FVC (r = -0.3478) and MVV (r = -0.4843) were significantly and negatively correlated with the duration of diabetes mellitus. These findings were consistent with findings of Davis et al [12] and Timothy et al [11] study. They also suggested that the reduced lung volumes and air flow are due to chronic complications of type II diabetes.

Thus this study shows a strong association between the duration of diabetes and pulmonary function impairment. Our findings were also supported by Kanya Kumari et al [22] and Nandhini et al [23].

CONCLUSION

The present study shows that the pulmonary function is reduced in type II diabetics and of restrictive pattern. As the duration of diabetes increases the restrictive lung impairment becomes more prominent. These findings are of importance in that they demonstrate the need for prevention of lung damage. Therefore the patients with diabetes are suggested to undergo pulmonary function testing periodically. Strict glycemic control and regular breathing exercises to strengthen respiratory muscles is necessary to improve the pulmonary function in type II diabetics.

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Changes of EEG Pattern in Blind Children –
A Comparative Study

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ABSTRACT

Background: The electroencephalogram is a unique and valuable measure of the brain's electrical function. There have been few studies of EEG reported regarding the absence of alpha rhythm in blind subjects. Most of the studies indicate that the alpha activity is reduced or even missing in blind subjects. **Aims & Objectives:** To evaluate EEG patterns in blind children and to compare this pattern with age and sex matched sighted children and to know whether there is any relation between alpha rhythm and blindness. **Materials and method:** 30 normal sighted and 30 blind children aged 10-15 years from school for the blind were subjected to EEG recording using Computerized Digital Electroencephalograph (Medicaid NV 3200) Neuro-Vision Plus. Subjects were made to lie down on a couch in supine position, mentally relaxed with eyes closed and without any movements. A 16 channel EEG was recorded for each subject. **Results:** It was found that there appears nosignificant difference between them. Duration of blindness has no effect on EEG pattern. **Conclusion:** EEG pattern and the alpha rhythm is found to be normal in both subject and controls.

Keywords: Blind children, EEG pattern, Alpha rhythm.

INTRODUCTION

Electroencephalogram (EEG) is recording of electrical activity of the brain. It provides a non-invasive and inexpensive measure to directly measure brain function and make inferences about regional brain activity[1]. EEG signals have permitted closer links between psychic events and brain electrical responses[2]. There have been few studies of EEG reported on the absence of alpha rhythm in blind subjects[3]. The functional organization of human primary visual and auditory cortices is influenced by sensory experience and exhibits cross-modal plasticity in the absence of input from one modality[4]. Our study is mainly done to know if any particular EEG pattern is associated with blind children without going to know the cause for their blindness.

MATERIALS AND METHOD

Study of EEG pattern in blind children was conducted in the department of Physiology, KIMS, Hubli with the assistance of department of Psychiatry, KIMS, Hubli from July 2011 to June 2012. It was planned to conduct this study on 30 subjects (blind children aged 10-15 years) from school for the blind in Hubli. A time bound comparative study of EEGs of congenitally blind and age and sex matched normal sighted controls was chosen.The study was designed and no intervention or invasive investigation was required. Ethical clearance was obtained from the Ethical committee of KIMS, Hubli. We visited the school for the blind, met the Principal of the school and discussed the objective and need for the study with the Principal and care givers.

Method of data collection: We conducted personal interviews with the students to know about their visual status and duration of blindness. The care givers were also involved in obtaining necessary data regarding the student's blindness. Identification data, name, age, sex and address were recorded. Age was calculated in years to the nearest birthday. Height and weight of each child was recorded. Available school records and personal records were collected from the principal and verified and necessary details were noted.

Inclusion and exclusion criteria:

Inclusion criteria of subjects:

Congenitally blind children 2) Age group 10-15years 3)Both males and females

Exclusion criteria of subjects:

Age< 10years or >15 years 2) H/O Epilepsy and other neurological illnesses3) H/O medications.

History taking and clinical examination:A thorough history of the subjects was taken. Clinical examination of respiratory system, cardio-vascular system, nervous System and special senses were conducted on each blind child and each control. Ophthalmological assessment was specially carried by ophthalmologist in order to know the visual status.

EEG recording: EEGs were recorded in the department of Psychiatry, KIMS, Hubli. EEGs were recorded using Computerized Digital Electroencephalograph (Medicaid NV 3200) Neuro-Vision Plus. Students were accompanied with caretakers throughout their participation in the test.

Procedure: Counselling was done to prepare the subjects mentally and physically for theprocedure. Instructions were given to each subject about the procedure to be done. Each subject was made to lie down in supine position, mentally relaxed with eyes closed and without any movements. Necessary data of each subject was fed to the system and required settings were done with the assistance of EEG technician.

24 electrodes were dipped in electrode paste and applied on the scalp as per the 10-20 system. (On Right side: FP2, F4, C4, P4, O2, A2, F8, T2, T4, T6. Midline: FZ, CZ, PZ, OZ. On Left side FP1, F3, C3, P3, O1, A1, F7, T1, T3, T5)**.** A 16 channel EEG was recorded for each subject and the individual reports were stored in separate CDs for interpretation.

Statistical analysis: Statistical methods-ANOVA were employed in the present study using SPSS-20.

RESULTS

EEGs were analysed and interpreted by visual inspection of the wave forms (called grapho-elements). Comparison was done between EEGs of blind and normal sighted children without any other history except for age of the individual.Reporting was done pertaining to Age, Sex, Schooling, Handedness,Type of record, Quality of record,Background activity,Paroxysmal activity, Artifacts, Activation procedure.

Background activity of the EEG was analyzed in all the preset montages available (B-map, Montage Child, Montage-I, Montage-II). Alpha rhythm was analyzed in Montage Child.EEGstaken in posterior occipital regions (O1-A1and O2-A2 channels) were reported with respect to frequency and amplitude by visual inspection and measuring with a scale. Monitor settings for reporting were: 1)Time constant- 0.3.2)Sweep speed- 30 mm/sec3)Sensitivity- 7µV4)Low filter- 1 Hz5) High filter- 70 Hz,6)Notch ON

In our study, normal alpha rhythm is present (8-13 Hz) in the blind and there is no significant difference between frequencies and voltages of controls and subjects.Our subjects were of different ages (10-15 years).It was found that mean frequency in 11 years is 10.66 Hz, 12 years is 10.4 Hz, 13 years is 10.66 Hz and 14 years is 10.5 Hz. There is no statistically significant difference in mean frequencies of different age groups. Mean voltage in 11 years is 28.83 µV, 12 years is 26.6µV, 13 years is 25.35 µV and 14 years is 22.5 µV. There is no statistical significance in mean voltage in different age groups.
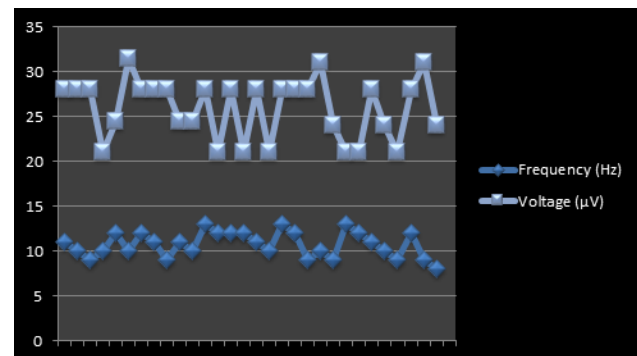
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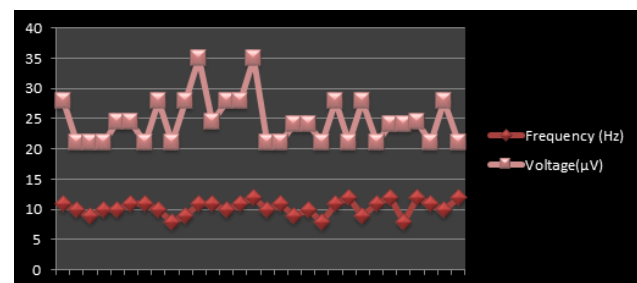
GRAPH-II: CONTROLS

DISCUSSION

Our results also show that EEGs of majority of normal visually impaired children showed normal alpha behavior[5].

The various controversies and disputes about the nature and significance of the alpha rhythm may be traced to this fact, and a good example is found in the opinions expressed by different authors on the E.E.G. in blind persons.[6]

James et.al found that EEGs of majority of normal visually impaired children showed normal alpha behavior.[7]

Baudouinet. al. stated that there was some alpha rhythm in the totally blind, but reported on too few cases.Lemere (1942) claimed that persistence of the alpha rhythm when looking at an object indicated true blindness.[8]

In our study, EEG pattern and alpha rhythm has been found normal between age and sex matched blind subjects and controls. Frequencies and voltages did not show statistical significant difference between blind subjects and normal sighted controls. In our 30 cases, normal alpha rhythm is present (8- 13 Hz). This finding is also observed by some authors. The alpha rhythm is seen in posterior regions of head, both sides, higher in amplitude on dominant side.The duration of blindness has no impact on EEG pattern with respect to voltage and frequency. This observation has not been made in most of the studies.

Since, ours is a time bound study, we have made our efforts to know the EEG pattern and alpha rhythm in about 30 cases without going through to know the exact cause of blindness. We also did not find any asymmetry of alpha rhythm.

To conclude, the results of the present study suggest that EEG pattern and alpha rhythm has been found normal between age and sex matched blind subjects and controls.

CONCLUSION

EEG pattern related to background activity, frequency and voltage have been found similar between blind subjects and normal sighted controls.

Normal alpha rhythm is present (8-13 Hz) in the blind and there is no significant difference between frequencies and voltages of controls and subjects.

Duration of blindness has no effect on mean frequency and mean voltage.

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Cardio Respiratory Responses between Treadmill and Ergometer Cycle

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ABSTRACT

This study was done to determine the cardio respiratory differences between Treadmill Running and Ergometer cycling. This study was undertaken in research laboratory of physiology department at Thanjavur medical college. 40 persons with the age group of 18-40 Years were taken as subjects. The subjects were recruited from Thanjavur medical college. The subjects were performed 3 discontinuous graded tests until exhaustion. In Bicycle, cycling was done for 2 mins at 60rpm. In Treadmill, initial Warm-up slowly by walking at a speed of 1.5-2 mph for 1min to 2 min. For first 2 weeks subject was asked to run at 4-8 mph for 20 minutes, 3rd week to 12th for 30 mins at 4-8 mph. Physiological variables such as Maximal oxygen uptake (VO2max), maximal heart rate were measured and compared in between Ergometer Cycling and Treadmill Running.

Keywords: *Maximal oxygen uptake, maximal heart rate*

INTRODUCTION

For those who strive to achieve and maintain a high quality of life, it must be recognized that Physical activity is vital to optimal health. In addition to prolonging the quantity of life, physical exercise enhances the quality of life by improving respiratory and cardiovascular functions. Exercise testing is a noninvasive test to evaluate cardiovascular responses to exercise. Despite the many advances in technology for the diagnosis and treatment of cardiovascular diseases, the exercise test remains a very important diagnostic modality. So many modalities have been used to provide dynamic exercise. However the bicycle ergometer and treadmill are the most commonly used dynamic exercise devises[1].

Not only for excise testing and maintenance of physical fitness, nowadays these are the most common modalities used to determine aerobic capacity of an individual. VO_2 max is a measure of maximal capacity of cardiorespiratory system to obtain, utilize oxygen to meet energy need of muscle contraction.

Hence Aerobic capacity is a measure of oxygen delivery and utilization, it is the most reliable and influential prognostic.

Direct measurement of maximal oxygen consumption needs an expensive laboratory for gas analysis. Hence various predictive tests can be used to evaluate cardiorespiratory fitness, these include treadmill walking, running and submaximal ergometer cycling[2]

Thus the increased use of both exercise modalities has escalated the need to compare their relationships between them.

The purpose of the study was to compare maximal oxygen consumption, maximal heart rate in treadmill and ergometer cycling exercise.

C. Abrantes et al analyzed metabolic and cardiorespiratory responses between treadmill and ergometer cycling. They found significant mode effect in heart rate and oxygen uptake. Treadmill protocol elicited higher heart rate and oxygen uptake[3].

Martinez et al made physiological comparison of different modes and found the highest aerobic power and maximum heart rate was elicited by treadmill than cycling.[4]

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G.A.McKay et al observed performance on bicycle ergometer and treadmill, confirmed that peak Vo_2 during bicycle ergometry is significantly less than VO_2 max attained in treadmill running[5].

MATERIALS AND METHOD

Study is a randomized control trial for 12 weeks, comparing the physiological responses in treadmill and ergometer cycle.

Subjects were recruited from Thanjavur Medical College Hospital,in the age group of 18-40 years age group. This study was conducted in the research laboratory, Department of physiology, Thanjavur Medical College. 40 female subjects with age group of 18-40 years participated in this study.

Subjects were randomized in to two groups, Group A- Treadmill group;Group B- Ergometer cycle group. Group A consists of 20 subjects who underwent treadmill training and Group B consists of 20 subjects who underwent cycling.

Before starting our study, we obtained ethical committee approval and clearance from our college. Informed consent was obtained from all subjects who were participating in the study. Healthy females with 18-40 yrs were included for this study.

Subjects with history of diabetes, hypertension, coronary artery disease, pulmonary disease, epileptics ,on chronic medications, pregnant / lactating individuals were excluded from the study. Study participants were divided into two groups, Group

A –Treadmil group (n=20), Group B-Ergometer cycle Group(n=20). Heart rate and blood pressure (systolic &diastolic) were measured at rest.

In Treadmill each exercise session was preceded by 10 mins warm up and stretching with 1.7 mph in treadmill, then increasing the speed to 4-8 mph for 20 mins duration during the initial 2 weeks. From 3rd week onwards duration increased to 30 mins. Duration & speed was increased slowly up to exhaustion level of the subject. In cycle each exercise session was preceded by warm up and pedaling speed of 30-40 revolutions per min(RPM),with resistance level in one kilopond.

Pedaling speed was gradually increased to 60-70 RPM for 15 minutes with resistance being increased from 1to 4 in the tension adjuster gradually. Each session is followed by 10 minutes cool down with light stretching exercises.

Exercise session continued for 5 days in a week for 12 weeks.

VO_2 max was calculated using **Pederson formula[6]**

$$\frac{HR \ max}{HR \ rest} \times 15$$

Heart rate was measured continuously throughout the testing session. Resting heart rate (RHR) was identified as the lowest HR among the eight 15 sec intervals between minutes 7 and 9 of the rest. The highest heart rate during exercise session was considered as HR max [7]

During exercise, heart rate, oxygen saturation in the blood was monitored using finger pulse oximeter.

RESULTS

This study was conducted between treadmill runners and ergometer cyclists; results were recorded for the following parameters and compared between both groups. Students paired t test was used to compare between treadmill and ergometer cycle group.

We used a level of significance of 95%(p value <0.05 as significance)

The parameters include;

I.maximum heart rate

ii.maximum oxygen consump

The mean difference between pre and post tests of treadmill and cycle groups were

Compared .Results showed significant increase of mean MHR & VO2 max in treadmill exercise group.

MAXIMUM HEART RATE (HR max)

The mean value of maximal heart rate in treadmill group was 166.7±4.92 and the mean value of maximal heart rate in ergometer cycle group was 156±9.85.

Paired t-test result showed a statistically significant difference in MHR[P value of .000 (p>0.05)] . Mean HR max highest in treadmill group.

TABLE 1: Comparison of MHR between treadmill group & ergometer cycle group:

Group	Mean	SD	't' value	'p' value
TM group	166.7	4.92	4.119	0.000
EC group	156.5	9.85		

II. VO_2 MAX COMPARISON

The mean value of VO_2 max in treadmill group was 30.95±2.69 and the mean value of vo_2 max in ergometer cycle group was 26.86±6.16.

There is significant increase of mean VO_2 max in treadmill group with P value of .010 (p <0.05).

TABLE 2: Comparison of VO_2 max between treadmill group and ergometer group

Group	Mean	SD	't' value	'p' value
TM group	30.95	2.69	2.717	.010
EC group	26.86	6.16		

DISCUSSION

Exercise is a period of enhanced energy expenditure[8]. Another beneficial effect of exercise is the development of greater cardiac efficiency and provides greater contractile power to heart. By increasing vascularization of the cardiac muscle, may delay the onset of atherosclerosis. By increasing demand of the myocardium for oxygen leads to development of collateral vascular channels in the ischemic areas and thus improves delivery of oxygen to damaged cells [9]. Treadmill and ergometer cycle are the most commonly used modalities to determine cardio respiratory fitness of an individual.

The Aerobic capacity indicates an individual's functional status and integration of the cardio respiratory system.

It is defined as the highest attainable rate of aerobic metabolism during performance of rhythmic muscular work maximal.

In the present study, I have assessed and compared maximal heart rate response and oxygen consumption .

From hemodynamic studies performed over years, maximal heart rate has emerged as clearly the most important determinant of cardiac output during exercise.

HR max is commonly used as the indicator of maximal exercise.

The present study showed a VO_2 max difference in favor of treadmill.

VO_2 max reflects a greatest capacity for cellular utilization of oxygen[10].

VO_2 response is a very much valuable index which reflects the oxygen transport and muscle metabolism[10] .

Researchers hypothesized in concerning VO_2 max is ,if greater muscle mass used in exercise task the greater the VO_2 max[11] .

In the present study, there was a significant increase in maximal heart rate and VO2 max in treadmill running than ergometer cycling.

There exists many studies to support my study result.

Miyamura et al observed marked differences in maximum oxygen uptake by comparing maximal work on the treadmill and on the bicycle ergometer ,18% higher VO_2 max observed in treadmill. The lower VO_2 max in cycling is associated with smaller (a-v) difference and smaller cardiac output[12] .

J.Faff et al found the highest HRmax during

treadmill exercise in both males and females, they reported higher aerobic capacity in treadmill than exercising on ergometer cycling. Greater energy expenditure during treadmill running resulted in high HRmax values[13] .

C.Abrantes et al analyzed metabolic and cardiorespiratory responses between treadmill and ergometer cycling. They found significant mode effect in heart rate and oxygen uptake. Treadmill protocol elicited higher heart rate and oxygen uptake[3].

In Faulker et al found that lower VO_2 max was associated with lower stroke volume. In cycling cardiac output is low compared to running, which may be due to limited venous return contributes to reduced cardiac filling, there by influencing oxygen consumption. Peripheral blood flow to lower extremities during cycling is different[14].

In cycling cardiac output is low compared to running, which may be due to limited venous return contributes to reduced cardiac filling, there by influencing oxygen consumption. Peripheral blood flow to lower extremities during cycling is different[14] .

Walaa Mohamed Elsais et al studied physiological responses during both incremental cycling and treadmill exercise to volitional exhaustion .The results revealed that maximum oxygen uptake was significantly higher in treadmill as compared in cycle ergometer [15].

Montgomery et al showed VO_2max ranges from 52 to 58 ml.kg. min^{-1} on the cycle ergometer,but VO_2 max ranged 54 to 62 ml.kg.min^{-1} on the running treadmill. According to Montgomery, running treadmill will elicit VO_2 values that are 10% higher than the cycle ergometer[16] .

Moghiseh et al observed the association of VO2max and heart rate in casting industry workers. Their results showed that there was strong correlation between heart rate and VO_2max and revealed that heart rate could be used as a prediction measure to estimate VO_2 max[17].

 Helan Carter Andrew studied the physiological effects of oxygen uptake, comparison was done between treadmill and cycle group .Study results showed treadmill is a high energy expenditure instrument compared to ergometer cycle[18].

Kasch et al observed higher VO_2 max in uphill

running can be due t longer duration o test and fast running rate, these factors produces greater muscle demand for oxygen[19].

Medelli et al observed that in cycling VO_2 max was limited by adaptation of heart capacity and compared with running, cycling induces great stress on respiratory mechanisms. The possible explanations are 1. greater metabolic acidosis could be origin of greater pulmonary ventilation on cycling.2.In cycling ,greater strain on leg muscles causes an increase in neurostimuli from leg proprioreceptors. In treadmill running, the strain is uniformly distributed over active muscles and the action of neural impulse is less active[20].

CONCLUSION

This study was designed to compare cardiorespiratory responses between treadmill running and ergometer cycling.

The results of the present study indicated that treadmill running elicited higher cardio respiratory responses than bicycle ergometer. HRmax and VO2 max can accurately measured by treadmill, therefore the sensitivity in detecting myocardial ischemia is higher in treadmill than ergometer cycling.

On the other hand, treadmill exercise produces less hemodynamic stress on cardiovascular system . Thus treadmill can be recommended for development of cardiovascular/respiratory fitness.

Conflict of Interest: The authhours hae no conflicts of interest that are directly relevant to the content of this article.

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Effect of Yoga Therapy on Heart Rate Variability and Blood Pressure in Sedentary Males

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ABSTRACT

Background: Reduced physical activity increases metabolic and cardiovascular risks. Yoga is an ancient science which has been shown to revitalize physiological and psychological functions. In this study, we aimed to assess twelve-week yoga intervention in sedentary males.

Methodology: 50 sedentary men in the age group of 25-45 years were recruited for our study. They were randomly divided into control group (n=25) and study group (n=25). Yoga intervention was given to study group participants for 12 weeks. Heart rate variability (HRV) and blood pressure were recorded before and after intervention (Yoga therapy).

Results: The groups were similar in age and body mass index. We observed no baseline difference in HRV and blood pressure between the groups. However, there was a significant improvement in HRV in study group participants after yoga intervention.

Conclusion: Short-term yoga practice (12 weeks) can improve overall cardiovascular health by improving HRV in sedentary males.

Keywords: *Reaction time, Yoga therapy, Heart rate variability, Blood pressure*

INTRODUCTION

Physical inactivity is the primary reason for the onset of lifestyle-related diseases such as hypertension and cardiovascular disease [1]. Increasing trends in adult male mortality have been reported from India [2] which might be due to decreasing physical activity. Further sedentary lifestyle is more harmful in males than females as female hormones are cardioprotective [3].

Increased resting heart rate per se is an indicator of cardiovascular disease [4] and it is well established that increased blood pressure increases the risk of cardiovascular risk[5]. Heart rate is influenced by various physiological factors, including physical/psychological stress/cognitive functions[6] and lead to beat to beat fluctuations in heart rate.- Heart rate variability (HRV). This reflects the cardiac autonomic function of an individual and is a non-invasive indicator of cardiovascular health [7].

Yoga involves mind-body technique through asana, pranayama, and meditation [8]. However, the effect of 12 weeks with the yoga module (yoga techniques which we have designed) on HRV and blood pressure among sedentary male are not systematically studied. Hence, we have evaluated the effect of short-term yoga therapy (12 weeks) on HRV and vascular tone (SBP and DBP).

MATERIALS AND METHOD

Participants

The study was carried out as a part of an M.Sc dissertation under Tamil Nadu Physical Education and Sports University. After initial assessment (Medical history and general physical examination), we requested the volunteers to fill the global physical activity

questionnaire (GPAQ). Based on GPAQ assessment, we enrolled 50 apparently healthy sedentary males belonging to the age group of 25 to 45 years from Puducherry population. The study commenced after obtaining written informed consent from them.

Experimental design

The present study is a simple, randomized control trial. After baseline recordings, the subjects were randomized into two groups as follows – Study group (n=25) and Control group (n=25). 12 weeks of yoga therapy was given to study group alone in the evenings. After the intervention period, all the parameters were again recorded in both the groups.

Anthropometric measurements

Height was measured using a wall-mounted stadiometer (V M Electronics Hardware Ltd). Weight was measured using a digital weighing machine ((Charder Electronic Co. Ltd Taichung, Taiwan). BMI was calculated using Quetelet's index = Weight (kg) / [Height (m)]^2 [9]

HRV recording

We followed Task force for recording short-term HRV [7]. Lead II electrocardiogram was recorded in the supine position after 10 minutes rest. The short-term HRV recording was obtained by retrieving RR intervals from the ECG (Bioharness (Zephyr, USA), a portable, wireless data acquisition system). Offline analysis was done using Kubios version 2.0 software (Bio-signal analysis Group, Finland). Frequency domain indices were expressed in ms^2 (Very low frequency (VLF), Low frequency (LF), Low frequency in normalized units LF (n.u), High frequency (HF), Total spectral power (TP =VLF + LF + HF), low frequency power in normalized units (LFnu = LF X 100/ (TP–VLF), high frequency power in normalized units (HFnu = HF X 100/ (TP–VLF) and LF/HF ratio (ratio of LF power to HF power) were computed. The time domain measures included various statistical measures from RR interval, including Standard deviation of all NN intervals (SDNN), the sum of the squares of differences between adjacent RR intervals (RMSSD), adjacent RR interval differing more than 50 ms (NN50) and adjacent RR interval differing more than 50 ms expressed in percentage (pNN50).

Blood pressure and Heart rate measurement:

Following 10 minutes rest[10], blood pressure was taken in the right arm in sitting position at the level of the heart using a mercury sphygmomanometer (Model: Diamond, Industrial Electronic & allied product Maharashtra, India). Blood pressure recordings were taken thrice with two minutes rest between intervals, and the average of it was taken as the final reading. Heart rate was assessed from the radial artery per minute manually

Intervention given

Table 1: Training schedule

S.No	Name of the practice	Duration (min)
1	Shavasana	4
2	Apanasana	2
3	Jatharaparivritti	2
4	Janusirasasana	2
5	Paschimottasana	2
6	Uttanasana	2
7	Trikonasana	2
8	Uthkatasana	2
9	Mahamudra	2
10	Kapalabhati	5
11	Surya Nadi Pranayama	5
12	Anulom-Vilom Pranayama	5
13	Meditation	20
		Total – 40 minutes

Each session of yoga therapy took about 1 hour. Therapy was be given three days a week for 12 weeks, and subjects were motivated to practice the same daily at home.

Yoga training was given during evening hours six PM to seven PM at least four hours after the meals in a well-ventilated room. Attendance register was maintained for the participants to ensure the regular practicing of yoga module. Minimum 80% attendance was considered to include the subjects in the study group.

Statistical technique

Data were expressed as Mean ± SD for normally distributed data and as Median (IQR) for non-normally distributed data. For normally distributed data (Table I and II)- Baseline comparison between the control group and the study group was done using unpaired 't' test. Comparison of pre- and post-values was done using paired Student 't' test. For non-normally distributed data (Table III) - within-group comparison was done using Wilcoxon Signed Ranks test, and between groups, the comparison was done using Mann-Whitney U test. P-Value of less than .05 is considered as statistically significant. SPSS version 19 was used for analysis. *comparison between pre-and post within the group. * $p < 0.05$, **$p<0.01$, ***$p<0.001$. # Comparison between control and study group (pre-vs pre, post vs. post). # $p < 0.05$, ##$p<0.01$, ###$p<0.001$.

RESULTS

Table I: Comparison of age and BMI between control and study group

Parameters	Control group (mean ± SD)		Study group (mean ± SD)	
	Pre	Post	Pre	Post
Age (years)	30.05±5.70		31.45±3.28	
Body mass index	22.41±3.80	22.70±4.42	22.53±3.34	21.79±3.09

Control and study groups were comparable before intervention (Table I, II and III) There was no significant change in any of the parameters measured in the control group after the study period of 12 weeks.

Even though Body mass index reduced in the study group after the intervention, the decrease was not significant. Both systolic blood pressure and diastolic blood pressure decreased after intervention in the study group. However, the decrease was statistically significant only in the systolic blood pressure (Table II). Heart rate was significantly decreased after intervention in the study group (Table III).

Table II: Comparison of cardiovascular parameters between control and study group

Parameters	Control group (mean ± SD)		Study group (mean ± SD)	
	Pre	Post	Pre	Post
Systolic blood pressure (mm Hg)	117.70±5.08	119.90±7.05	119.05±6.60	113.50±8.01*#
Diastolic blood pressure (mm Hg)	74.5±5.18	76.45±4.88	77.45±5.20	76.42±6.32

Table III: Comparison of heart rate variability parameters between control and study group

Parameters	Control group				Study group			
	Pre		Post		Pre		Post	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR
MeanHR	90.38	19.12	88.98	9.11	90.13	16.18	78.59***###	9.47
SDNN(ms)	61.85	42.3	70.1	50.78	69.6	41.95	90.75***###	49.25
RMSSD (ms)	59.65	52.4	75.1	50.78	78.65	52.88	107.05***###	48.73
NN50 counts	118	66.5	136.5	140.75	149.5	80	192.5***###	97.25
pNN50(%)	29.47	20.32	31.22	37.59	34.61	22.53	49.24***###	26.62
VLF(ms^2)	783	1277.75	838	1228	904	559.19	1067.5*#	703.25
LF(ms^2)	891	911.25	1211.5	1384	1094.5	1167.44	1563**##	1155.75

***Cont...* Table III: Comparison of heart rate variability parameters between control and study group**

HF(ms^2)	1555	987.69	1476.5	1419.75	1690.5	1711.5	2903***###	1993.25
TP(ms^2)	3458.5	2196.06	4028.5	3727.25	4022	3322	5745.5***###	3442
LF/HFratio	0.62	0.53	0.64	0.51	0.64	0.36	0.51***#	0.13
LFnu	0.39	0.19	0.39	0.18	0.39	0.12	0.34***	0.06
HFnu	0.62	0.19	0.62	0.18	0.61	0.12	0.66***	0.06

Total power and SDNN were significantly increased after intervention in the study group. Time domain parameters such as SDNN (ms), RMSSD (ms), NN50 counts and pNN50(%) significantly increased after intervention in the study group. Similarly, in frequency domain analysis HF power, HFnu were significantly increased and LF power, LFnu was significantly decreased. LF/HF ratio was shifted toward parasympathetic dominance after intervention in the study group (Table III).

DISCUSSION

Asian Indians are at high risk of diabetes, hypertension and cardiovascular diseases [11, 12] and these lifestyle-related disease occurs mainly due to physical inactivity. Yoga is a cost-effective lifestyle management that can be followed by all age group. However, yoga has not received required attention. Hence, the present study was undertaken to create awareness about yoga in sedentary males and to explore the effects of yoga on HRV and cardiovascular parameters (blood pressure, heart rate) in sedentary males.

It is well known that age and BMI influence blood pressure [13] and HRV [14]. Many studies have reported a decrease in BMI after yoga intervention [15, 16]. Lack of significant change in BMI in our study group may be because study participants were in normal cut-off Asian BMI range [17].

We observed a reduction in heart rate following yoga intervention in study group comparing control group which could be due to increased parasympathetic tone and reduced sympathetic tone. This might be due to the yogic postures [18] or pranayama [19] or meditation [20] which are reported to induce vagal outflow directly by stimulating the vagus nerve. Contradictory to our research findings few studies have reported increased heart rate following yoga intervention[21] and increased HR fluctuation was noticed following slow breathing technique in LF band [22, 23].

We noticed significant improvement in time domain parameters (SDNN, RMSSD, NN50, pNN50) and frequency domain parameters (HF power, HF n.u.) following yoga module which shows improvement in vagal tone. These findings of our study are in accordance with Muralikrishanan et al.[24]. The reduction in resting heart rate following yoga intervention might be achieved by restoring sympathovagal balance (Reduced LF/ HF ratio following yoga intervention). The exact mechanism for increased HRV following yoga intervention could be the contribution of top-down and bottom-up neural network integration [25].

The reduction in systolic blood pressure among study group following yoga therapy might be due to the decreased sympathetic tone (LF power and LF n.u.) or shifting hypothalamo-pituitary axis towards vagal dominance or restoration of baroreflex sensitivity [26, 27] or baroreceptor resetting. Further, reduction in blood pressure following yoga intervention has been reported by many authors in different groups of the population[28-30]. We observed a reduction in blood pressure even in normotensive subjects. The adverse effects of blood pressure are like spectrum and shown to increase with an increase in blood pressure with each mmHg increase in blood pressure[31]. Even a drop of 2 mmHg is considered beneficial and has been shown to reduce cardiovascular morbidity and mortality[32]. We have observed six mmHg decrease in our study which will of great benefit to the study participant in the longer run. However, there was no significant change in diastolic blood pressure in our study.

We conclude that yoga has a beneficial effect on HRV, BP, and HR which emphasizes the importance of yoga for a healthy lifestyle.

Limitation

We have not measured body fat percentage. Body fat is known to influence HRV and blood pressure. Even though there was no significant change in BMI, body fat

percentage could have changed which in turn could have played a role in reducing sympathetic dominance.

CONCLUSION

Yoga has got the beneficial effect on HRV, BP and HR by increasing parasympathetic tone and decreasing sympathetic tone in sedentary males.

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A Comparative Study of Audiovisual Reaction Time between Urban and Rural Children in the Age Group of 11-16 Years

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ABSTRACT

Reaction time is the interval between onset of a signal(stimulus) and the initiation of a movement response. Age, alertness, concentration, degree of physical fitness and training[1,2] are some of the factors which can affect reaction time in urban and rural children. The purpose of our study is to measure & compare audiovisual reaction time among them. Our study included 11-16years of school going children, 60 from urban and 60 from rural school. Their height and weight were recorded and BMI was calculated. The simple reaction time was measured using audio visual reaction time apparatus and data was compared between urban and rural children. Students unpaired "t" test was used for the analysis of data. The reaction time of rural school going children was found significantly better (p<0.05) than urban school going children. More physical activity and less sedentary life styles probably be the reason for better reaction time in rural children as compared to urban children.

Keywords :- *Reaction time; urban & rural children; Body Mass Index.*

INTRODUCTION

Reaction time (RT) is the elapsed time between the presentation of a stimulus which can be of any modalities of sensory input like visual, auditory, pain, touch or temperature and the subsequent behavioral response to occur[3]. Reaction time measurement is a reliable indicator of processing of sensory stimulus by central nervous system and it's execution in the form of a motor response[4]. It is an important method used for central information processing; speed and coordinated peripheral movement responses[5]. Degree of physical fitness, activity, BMI and various other factors can affect reaction time in urban and rural children[6,7].

In the past few years, the prevalence of overweight & obesity in children and adolescents has been increased in Indian population. Overweight and obesity primarily happen due to Excess calorie intake or insufficient physical activity or both. Childhood obesity is a forerunner of metabolic syndrome, poor physical health, mental disorders, respiratory problems and glucose intolerance, all of which can track into adulthood[8,9]. Thus, we have planned this study to assess psychomotor ability in rural and urban school going children using audiovisual simple reaction time as a parameter.

MATERIALS AND METHOD

The present study was conducted on 120 subjects after obtaining the approval of Institutional Ethics Committee. This study was carried out in the Nagpur district of Maharashtra, India. Our study included 11-16 years of school going children; 60 from urban and 60 from rural school. Written informed consent of the study subject was obtained after explaining the nature and purpose of the study.

The height and weight of study subjects were recorded and BMI was calculated. The Auditory

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and visual reaction time was measured by Response Analyzer by "Yantra Shilpa" System in a quiet room with good visible conditions. The visual reaction time was recorded for red, green and yellow color components and Auditory reaction time was recorded for low frequency & high frequency components. The data was compared between urban and rural children. Students unpaired "t" test was used for the analysis of data using graph pad prism software.

RESULTS

The values of visual reaction time for red (p=0.0004*), green(p=0.001*) and yellow (p=0.0001*) color components were found significantly better in rural children than that of urban children of the same age group. The low frequency (p=0.0001*) and High frequency (p=0.0057*) components of Auditory reaction time were also found significantly better in rural children. The BMI (p=0.0009*) of urban children was found significantly higher than the rural school going children.

Table no. 1: Comparison of BMI, ART and VRT in urban and rural school going children.

Sr. No.		URBAN CHILDREN (MEAN±SD)	RURAL CHILDREN (MEAN±SD)	p-value
1	**BMI**	17.57±2.71	15.91±2.71	0.0009*
	VRT			
2	**RED**	0.409±0.071	0.362±0.072	0.0004*
3	**GREEN**	0.435±0.086	0.369±0.085	0.001*
4	**YELLOW**	0.474±0.097	0.371±0.094	0.0001*
	ART			
5	**LF**	0.435±0.089	0.357±0.089	0.0001*
6	**HF**	0.379±0.068	0.343±0.067	0.0057*

BMI- Body Mass Index; VRT- Visual Reaction Time; ART- Auditory Reaction Time; LF- Low Frequency; HF- High Frequency; SD- Standard Deviation; *- significant p-value <0.05.

DISCUSSION

The auditory and visual simple reaction time of rural school going children was found significantly better than urban school going children (p<0.05). The results shows that the processing of sensory stimulus by central nervous system and it's execution is better in rural children as compared with urban children. Saha et al. (2012)[10] also noted improved reaction time and other health related physical fitness variables in rural children. More physical activity and less sedentary life styles probably be the reason for better reaction time in rural children as compared to urban children.

Also in our study the auditory reaction time is found better than visual reaction time. Shelton J et al (2010)[11] observed the same results in their study. Many factors could contribute to higher reaction time in urban

population than rural school children. In our study, we found higher BMI in urban children. However it cannot be ascertained weather it contributed to higher Reaction Time. It needs further larger & well designed studies.

CONCLUSION

In our study on young healthy population, auditory and visual simple reaction time was significantly better in rural population than urban (p<0.05). Also BMI was higher in urban population group (p<0.05).

Conflict of Interest - None

Source of Funding - Self

Ethical Clearance :- Permission from Institutional Ethical Committee was taken. The written informed consent was taken from students/parents/guardian.

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Effect of Hypothyroidism on Cardiac Autonomic Functions by Short Term HRV Analysis

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ABSTRACT

In the modern world, Heart Diseases are quiet alarming, due to their complications. This study involves, Estimation of serum TSH level in the study and control population

Analysis of short term Heart Rate variability using the Time Domain Parameters in the study and control population, **Materials and Method:** This study was done in the Institute of Physiology, Madurai Medical College, Madurai in association with the Department of Endocrinology and Metabolism, Government Rajaji Hospital attached to the Madurai Medical College, which has 16,000 running cases of hypothyroidism from 1985 onwards, with proper registration and follow up. The study group consists of 25 subjects who were newly diagnosed hypothyroid individuals in the age group of 20 – 40 years, of which 20 were females and 5 were males, who were free from any other diseases. The control group consists of 25 subjects who were age and sex matched, normal and euthyroid, free from any other diseases. Written consent was obtained from the subjects before procedures.results tabulated, statistically analysed using' t ' test.

Keywords : *Heartrate variability , thyroid, RR interval, physiopac, short term*

INTRODUCTION

In the modern world, Heart Diseases are quiet alarming, due to their complications. Nowadays people are aware of the modern technologies and recent investigations available for heart problems. One such is Heart Rate Variability analysis. Sahin I & Turan N[1], in their article in Journal. Endocrinol. Invest., stated that Heart rate variability (HRV) analysis is an analysis of beat-to-beat variations in heart rate, is an important and widely used non-invasive method to asses autonomic function. Levy MN[2], says that Heart rate and rhythm are the result of the intrinsic automaticity of the Sinoatrial node (pacemaker of heart) and the modulating influence of the autonomic nervous system.

The normal cardiac autonomic innervations and its activity is essential for normal Heart

Rate Variability. Heart Rate Variability is a measure

of neuro-cardiac function

AIM AND OBJECTIVES OF THE STUDY

This study involves,

1. Estimation of serum TSH level in the study and control population.

2. Analysis of short term Heart Rate variability using the Time Domain Parameters in the study and control population.

MATERIALS AND METHOD

This study was done in the Institute of Physiology, Madurai Medical College, Madurai in association with the Department of Endocrinology and Metabolism, Government Rajaji Hospital attached to the Madurai Medical College, which has 16,000 running cases of hypothyroidism from 1985 onwards, with proper registration and follow up.

The study group consists of 25 subjects who were newly diagnosed hypothyroid individuals in the age group of 20 – 40 years, of which 20 were females and 5

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were males, who were free from any other diseases. The control group consists of 25 subjects who were age and sex matched, normal and euthyroid, free from any other diseases. Written consent was obtained from the subjects before procedures.

Estimation of T_3,T_4 & TSH :

Serum analysis of T_3 T_4 & TSH were done in Madurai Govt Rajaji Hospital Laboratory by Radio immuno assay technique – a type of antibody – based competitive immuno assay.

Laboratory Evaluation :

Serum levels of TSH, total circulating T_4 and total circulating T_3 are measured by radioimmunoassay.

a) Patient Preparation for Serum TSH and Serum total T_4 and T_3 test:

As per "The Professional guide to diagnostic tests" published by Lipincott Williams and Wilnkins, was followed.

- Patient was explained that this test helps to assess his / her thyroid gland functioning.

- He / She was advised not to fast or restrict activity.

- Venuous Blood samples were collected by venepuncture and after needle puncture, patient or subject has to be in a recumbent posture for 30 minutes after the test.

Procedure and post test case :

- Between 6a.m. and 8.a.m. a venipuncture was performed and blood sample collected in a 5ml (or) 10ml clot – activator tube.

The sample were sent to the laboratory immediately so that the

Precautions to handle the sample gently to prevent hemolysis were taken.

- serum can be separated by centrifugation.

- Direct pressure was applied to the venipunctue site until bleeding stops.

b) Blood pressure : Blood pressure was recorded using sphygmomanometer and stethoscope.

c) Short-Term HRV Analysis

As per the recommendations of the Task force of the European Society of Cardiology and the North-American Society of Pacing and Electro-Physiology in 1996, the short-term HRV analysis is done on a Five(5) minutes recording of ECG.

Pretest instructions were given to the subjects as follows :

1. No heavy physical activity 24 hours prior to recordings.

2. No smoking or drinking alcohol or caffeinated beverag No smoking or drinking alcohol or caffeinated beverages after 9pm the previous day.

3. The recordings are taken 2 hours after a meal.

4. All recordings are taken in a temperature controlled and sound proof, well electrified room with the facility for continuous recording of ECG using the windows based computerized polygraph, installed with the physiopac computer software.

5. ECG Acquisition :

The ECG electrodes are placed over suitable bony points on the torso such that noise-free signals with good amplitude upright R-waves are obtained.

Lead II of the standard bipolar limb leads is used to obtain the ECG recording. ECG signals are acquired with adjustable and reusable electrodes. The electrodes are firmly fixed to the skin of the subject after applying the ECG electrode-gel over the skin. The ECG signals which are acquired with the ECG leads and amplifiers are digitized by an analog – to – digital converter, (Physio-pac).

Arrangement of Settings

We have to do the necessary arrangements for proper recording of the ECG by clicking the "Settings" option, and the following are set.

1. Sensitivity   -   1mv
2. Low cut filter   -   0.5 Hz
3. Hi cut filter   -   75 KHz
4. Notch   -   On

Test Conditions

All mobile phones should be switched off and recording should be done in a quiet room with controlled temperature. The subjects are instructed about the procedure. The ECG electrodes are the applied. Ensure that a clean, good recording is obtained. The subject is now made to rest quietly, without moving, in the supine positions with eyes closed for 15 minutes. Throughout this period ECG is acquired and at the end of the rest period from an average of the last 10 R – R intervals.

The procedure for off-line analysis of the recorded ECG is as follows:

1. Retrieval of recorded ECG – for this click the "view test" button to view selected subjects recorded data.

2. Click on the "Bookmark button" to place bookmark on the page from which we are going to trace the ECG waves continuously upto the end of 5 minutes.

3. Detection of 'R' Peaks :-

The 'R' peaks will be detected and marked with Time marker T_1, T_2, by clicking on the "markings"

option. Click on the "Bookmark button" to place bookmark on the page from which we are going to trace the ECG waves continuously upto the end of 5 minutes.

4. Getting the R – R intervals:

All the consecutive R – R intervals are noted in milliseconds in the continuous 5 minutes recording of ECG. This data is copied and transferred to a "Notepad" file and saved. This R – R interval data file can be fed into the software specialized for HRV analysis.

5. Analysis of Heart Rate Variability:-

The "Time domain analysis" of HRV can before using the statistical methods available in the Microsoft excel spread sheet. On the time – domain analysis the following parameters are analysed.

• Mean R – R interval

• Standard deviation of the R – R interval (SDRR)

• RMSSD (Root Mean Square of sum of Differences between successive R – R intervals)

In this same methodology, both the control and study group were analysed and results scrutinised.

Table 1 :   Comparison between The Study Group and The Control Group Applying the Student 't' test

	Mean Heart Rate	R-R Interval	SDRR	RMSSD	
Case	75.52	0.7981	0.0345	0.0331	Mean Value
	1.868	0.028	0.004	0.005	Standard Deviation
Control	73.12	0.8006	0.0346	0.0339	Mean Value
	0.875	0.017	0.003	0.003	Standard Deviation
t	0.8750	0.0556	0.0143	0.1000	
df	48	48	48	48	
p	0.3860	0.9559	0.9887	0.9208	

'P'value is > 0.05 , not significant .

Applying student 't' test between the subgroup of hypothyroid subjects with Serum TSH levels more than 100 µIU/ml and the normal controls.

Table 2:

	RMSSD	
Case	0.0168	Mean value
	0.008	Standard Deviation
Control	0.0339	Mean value
	0.02	Standard Deviation
t	2.80	
df	26	
p	0.02	

'p' value is < 0.05

indicating significance.

H rate Vs RMSSD (case)

H rate Vs RMSSD (control)
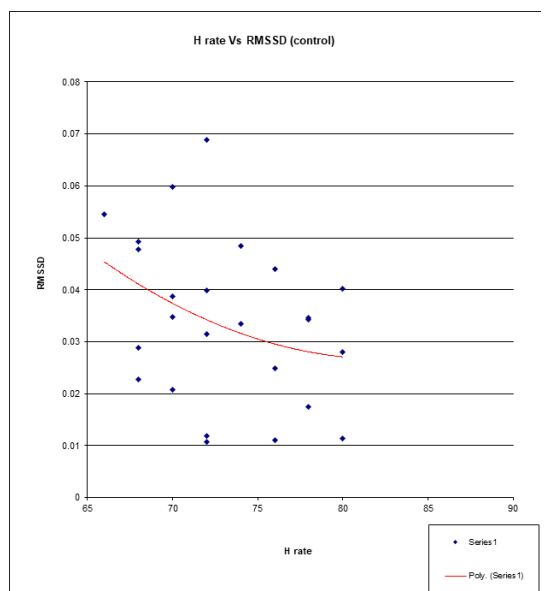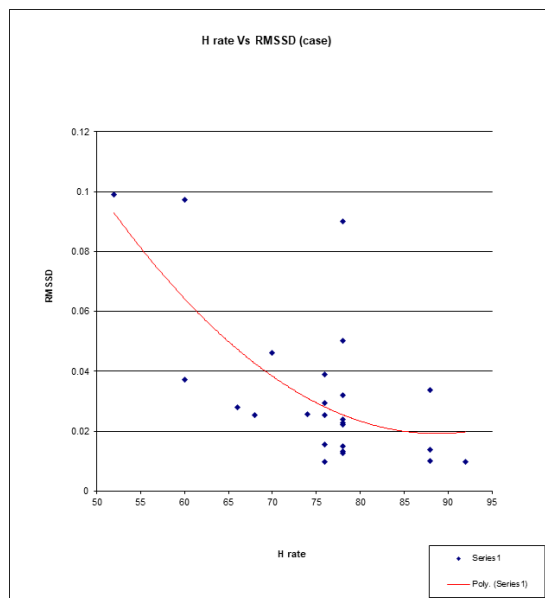
OBSERVATIONS

It is observed that the Mean value of the Mean R – R interval and the Standard deviation of the Mean R – R interval of the 25 study group subjects when compared to those values obtained from the 25 control group subjects, by applying student 't' test, the 'p' value derived is > 0.05, indicating that there is no significant difference in this parameter between the two groups.

And it is observed that the Mean value of the SDRR and the standard deviation of the SDRR of the 25 study group subjects when compare to those values obtained from the 25 control group subjects, by applying student 't' test, the 'p' value derived is > 0.05, indicating that there is no significant difference in this parameter between the two groups.

And it is also observed that the mean value of the RMSSD and the standard deviation of the RMSSD of the 25 study group subjects when compared to those values obtained from the 25 control group subjects, by applying student 't' test, the 'p' value derived is > 0.05, indicating that there is no significant difference in this parameter between the two groups.

Finally, it is observed that the Mean value of the SDRR of the subgroup of hypothyroid subjects with TSH levels more than 100 µIU/ml (Study group) and the standard deviation of the mean value of the SDRR of the study group subjects with normal TSH levels, by applying student 't' test, the 'p' value derived is 0.01, indicating that there is a significant difference in this parameter between these two groups. And it is also observed that the mean value of the RMSSD of the subgroup of hypothyroid subjects with TSH levels more than 100 µIU/ml (study group) and the standard deviation of the mean value of the RMSSD of the study group when compared to these of the 25 control group subjects with normal TSH level, by applying student 't' test, the 'p' value derived is 0.02, indicating that there is a significant difference in this parameter between these two groups.

So from the analysis of all these results it is clear that the time domain parameters of HRV of the hypothyroid subjects (study group) show a significant difference with that of the control group subjects in correlation with the TSH levels. Hence, the higher the TSH level, more will be the difference in the time domain parameters of HRV such as SDRR, RMSSD in the hypothyroid subjects

when compared to normal individuals.

DISCUSSION

Hypothyroidism is associated with a decreased sympathovagal modulation of the heart rate. The assessment of HRV in patients with overt - hypothyroidism may represent a useful tool in monitoring the cardiovascular – risks. (Galetta F & Franzoni F, 2008[3]).

Hypothyroidism can manifest with myriad cardiac abnormalities, often consisting of a combination of morphologic and functional changes. Low voltage, sinus bradycardia and slowed conduction are usually found on - electrocardiography. Severe primary Hypothyroidism of long duration (myxedema) can predispose to the potentially life threatening – arrhythmia of torsades de pointes (Polymorphic ventricular tachycardia). (Schenck JB and Rizvi AA, 2006[4]).

The cardio vascular system is sensitive to Thyroid hormone. (Biondi B, 2002). Decreased or Increased action of thyroid hormone on certain molecular pathways in the heart and vasculature causes relevant cardio-vascular derangements. Extensive evidence indicates that the cardiovascular system responds to minimal but persistent changes in circulating thyroid hormone levels, which are typical of individuals with subclinical thyroid dysfunction. Subclinical hypothyroidism is associated with impaired Left ventricular diastolic function and subtle systolic dysfunction and an enhanced risk for atherosclerosis and myocardial infarction. (Fazio S & Lombardi G, 2004[5]).

The present study has demonstrated that the time domain measures of HRV such as, mean R-R interval, SDRR and RMSSD in hypothyroid subjects may not be significantly different compared to those of healthy control group. But a statistically significant difference was observed in time domain measures of HRV such as SDRR and RMSSD between the subgroup of hypothyroid subjects with TSH level – more than 100µIu / ml and controls.

These findings are in agreement with the studies of Sahin I, Turan N and colleague in 2005 (Jr Endocrinal Invest. 2005 mar; 28(3): 209-13) on evaluation of autonomic affinity in patients with hypothyroidism. These findings indicate that Hypothyroidism may affect cardiac- autonomic activity in correlation with TSH

levels. So the evaluation of the effect of hypothyroidism on sympathovagal balance which modulates the cardiac autonomic activity, by using HRV method is necessary to avoid cardiovascular risks.

In 1995, Comtois R, Lemay C and colleagues proposed that patients with hypothyroidism seem to have an increased incidence of residual ischemia after studying cardiac patients (with myocardial infarction) with coexistent hypothyroidism. According to Kahaly GJ, 2000[6], Flow-mediated vasodilatation, a marker of endothelial function, is significantly impaired in subclinical hypothyroidism, and decreased heart rate variability, a marker of autonomic activity, suggests hypofunctional abnormalities in the parasympathetic nervous system. More specifically, the literature on cardiac involvement in subclinical hypothyroidism consistently shows that patients have resting left ventricular diastolic dysfunction evidenced by delayed relaxation, and impaired systolic dysfunction on effort that results in poor exercise capacity. Hence it appears that subclinical hypothyroidism should be considered a mild form of thyroid failure, associated with initial signs of cardio- vascular hypothyroidism, (Palmieri EA, 2002[7]).

CONCLUSION

From the present study, the results suggested that there is no significant difference between the hypothyroid subjects and the controls in the time domain measures of HRV such as mean R-R interval, SDRR and RMSSD. But there is a statistically significant difference observed in time domain measures of HRV such as SDRR and RMSSD between the sub group of hypothyroid subjects with TSH level more than 100µIU/ml.

The findings of this study clearly indicates that when the TSH level goes higher in hypothyroidism, it affects the cardiac – autonomic activity. Therefore, the assessment of HRV in patients with overt hypothyroidism proves to be an useful fool in monitoring the cardiovascular complications. As per Vanin LN, Smetner AS[8] and colleague, who have studied Thyroid function in patients with ventricular arrhythmia, substitution therapy for hypothyroidism was conducive to the disappearance of paroxysms of ventricular tachycardia and grades of ventricular extrasystoles in those patients. Since then there are numerous reports in the literature of investigation of relationship between thyroid dysfunction

and cardiac arrhythmias.

Even subclinical Hypothyroidism can alter autonomic modulation of heart rate. (Cardiac autonomic modulation is evaluated by HRV), Accordingly, early L-thyroxin treatment may be advised not only to prevent progression to overt hypothyroidism but also to improve abnormal cardiac – autonomic function. (Fallahi P, and Galetta F, 2006[9]).

According to Vanin LN, and Galetta F & Fallahi P, it clearly implies that if hypothyroidism is detected earlier and the treatment started at the earliest will definitely prevent the cardiovascular complications pertaining to hypothyroidism.

Decompensated hypothyroidism is accompanied with significant disorders of cardiac activity and imbalance of autonomic nervous system which are corrected in hypothyrosis compensation (Makusheva MV and Kileinikov DV, 2008[10]).

In patients with common benign cardiac arrhythmias and also having hypothyroidism, thyroid replacement therapy is safe and does not trigger an increase in arrhythmia frequency, (Polikar R and Feld GK, 1989[11]).

To conclude, short term HRV analysis is the best option to detect the cardiovascular complications in hypothyroid subjects earlier and timely treatment is advisable to avoid adverse cardiovascular effects.

Conflict of Interest : Nil

Funding Agencies : No

Ethical Clearance: Obtained from Institutional ethical committee, Madurai Medical College

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EEG Monitoring in Anesthetized Patients Cerebral Entropy as a Measure for Depth of Anesthesia– A Study

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ABSTRACT

Anesthesia is the ultimate trust of the patient reposed in the doctor

In anesthesia, we are targeting the nervous system. But, throughout the surgical procedure, we are monitoring the cardiovascular and respiratory status. An effort has been made in this study to monitor the targeted system and to show that it is better and more advantageous when integrated with the cardiovascular monitoring**. The aim was to show the variation in cerebral entropy in different phases of anesthesia and to study the benefits in using it as a monitor for the depth of anesthesia. After ethics committee approval, 40 patients in the age group of 15 to 65 belonging to ASA grade I and II scheduled for elective surgery under general anesthesia were enrolled for this study. Baseline Response Entropy (RE), State Entropy (SE), Heart Rate(HR), Blood Pressure (BP) values were recorded before the induction of anesthetic drugs. Entropy values were recorded with the instrument DatexOhmeda E-entropy module. Anesthetic drugs used were same for all the patients. The RE and SE recordings were recorded in all the five phases: Induction, Intubation, Post Intubation, Maintenance and Recovery at specific time intervals. Statistical analysis was done with ONE WAY ANOVA. The results showed that the mean RE and mean SE values are significantly varying in all the phases when compared to the baseline values (p value < .001) as evidenced by tukeys and tamhanes tests. The RE and SE changes are found to be varying more significantly than MABP.

Keywords: *Cerebral Entropy, Response Entropy, State Entropy, E-entropy module.*

INTRODUCTION

Biological systems are complex, open systems with a periodic variation of properties functioning on oscillatory dynamics. Human brain is also exhibiting the same rhythmical oscillatory behaviour, being recorded as the alpha, beta, theta, delta and gamma waves in the electroencephalogram. Gamma synchronization is said to be the neural correlate for consciousness. At the quantum level the extremely weak, vander-walls interactions in the hydrophobic pockets of the dendritic proteins arrayed in synchronized brain systems are thought to be responsible for the consciousness in an individual. These interactions are disrupted in general anesthesia[13]

Entropy is a word used in thermodynamics. It was first introduced by Sir Shannon in his information theory in 1940. Entropy means disorderliness. The variedness in the amplitudes and frequencies of the EEG waves is taken as the cerebral disorderliness [cerebral entropy] and is being quantified as a dimensionless value by a mathematical algorithm to correlate with the depth of anesthesia. In a conscious individual there is greater variedness therefore greater disorderliness resulting in a greater entropy value. As an individual loses his consciousness as it is occurring in anesthesia the waves in the eeg become more and more regular and the variedness in the amplitudes and frequencies decreases thus decreasing the disorderliness and therefore the entropy value.[10]

MATERIALS AND METHOD

INSTRUMENTATION

Entropy Module, E-ENTROPY[4]

GE DatexOhmeda single-width plug-in module with the unique

Entropy algorithm, designed for monitoring the state of the central nervous system during anesthesia

• Features two Entropy parameters

- Response Entropy (RE) - a fast reacting parameter for detecting activation of facial muscles

- State Entropy (SE) - a steady and robust parameter for assessing the hypnotic effect of anesthetic drugs in the brain FEMG quiets down as the deeper parts of the brain are increasingly saturated with anesthetics. The Entropy Module measures these changes by quantifying the irregularity of EEG and FEMG signals[4]

Table 1 - Guidelines of Entropy Range for Anesthesia[5]

Entropy Range	Effect of Anaesthesia
100	Fully awake and responsive
60 to 40	Clinically meaningful anaesthesia with low probability of consciousness
0	Suppression of cortical electrical activity

Table 2 - Measurement and Display Range of Response and State Entropy[5]

Parameter	Measurement Frequency Range	Display Range
RE	$0 < f < 47$ Hz	0 to 100
SE	$0 < f < 32$ Hz	0 to 91

Response Entropy is sensitive to the activation of facial muscles, (i.e., FEMG). Its response time is very fast; less than 2 seconds. FEMG is especially active during the awake state but may also activate during surgery. Facial muscles may also give an early indication of emergence, and this can be seen as a quick rise in RE.

The State Entropy value is always less than or equal to Response Entropy. The estimation of the hypnotic effect of anesthetic drugs on the brain during general anesthesia may be based on the State Entropy value. SE is not affected by sudden reactions to the facial muscles because it is based on the EEG signal.

Neuromuscular blocking agents (NMBA), administered in surgically appropriate doses are not known to affect the EEG, but are known to have an effect on the EMG[5]

STUDY

This study was conducted at Nizams Institute of Medical Sciences in collaboration with the Department of Anesthesia after taking necessary approvals from the ethics committees of both the institutes:

Osmania Medical College

Nizams Institute of Medical Sciences

Subjects

Patients in the age group of 15 to 65 belonging to class I or II of American society of Anesthesiologists were selected. (class I Normal without any risk factors)

(class II with risk factors like diabetes and hypertension)

Inclusion Criteria

There were all surgical gastroenterology and surgical oncology cases who were to undergo the surgery under general anesthesia.

Exclusion Criteria

Cases with any type of neurological illness (Amnesia, Seizures, CVA) were excluded from this study. Cases with end stage cardiac or respiratory diseases were also excluded from this study.

METHOD

Entropy values were recorded with the instrument DatexOhmeda E-entropy module.

Anesthetic drugs used were same for all the patients.

Glycopyrrolate (0.02 mg/kg body weight) and Fentanyl (Analgesic 2 microgram/kg) were administered as pre medication.

Induction was done with a standard dosage of propofol (2mg/kg body weight). Clinically loss of verbal response was noted.

After induction, patient was intubated and was put on ventilator. Atracurium infusion was started at a dosage of 0.01 mg/kg/min IV

Post intubation, patient was maintained on inhalational anesthetic:

Sevoflurane in the dosage of 0.5 - 2% IN 65% N2O/35%O2*

At the end of the surgery, reversal was done with Neostigmine (0.8 mg/kg body weight)

RE and SE values were recorded every four seconds in the induction, intubation, post intubation phases; every five minutes in the maintenance phase and every one minute in the recovery phase. Heart rate and blood pressure were recorded every one minute in the induction, intubation, post intubation, recovery phases and every five minutes in the maintenance phase

Table 3 – Showing details of each Phase

Phase	Description
Baseline	Entropy reading before induction when patient was brought to the surgical table
Induction	Readings taken when the patient was administered propofol intravenously
Intubation	Reading taken when the patient was being intubated
Post intubation	From the moment the patient was connected to the ventilator till the start of Inhalational anesthetic drug.
Maintenance	From the start of the inhalational anesthetics till their withdrawal
Recovery	From the moment of withdrawal of all the anesthetic drugs till the patient became conscious

STATISTICAL ANALYSIS

Data is represented as Mean ± SD. Statistical analyses were done using PASW 18.0 (SPSS Inc., Chicago, USA). One way analysis of variance or Welch/Brown-Forsythe test was done depending on the significance of Levene's test of homogeneity of variances. Tukey's and Tamhane's post-hoc tests were done for statistical significance. Statistical significance was set at $p < 0.05$.

Descriptive statistics

Table 4 - Means and SD of MABP, RE and SE

Parameter	Baseline Mean	Baseline Standard Deviation	Induction Mean	Induction Standard Deviation	Intubation Mean	Intubation Standard Deviation	Post-intubation Mean	Post-intubation Standard Deviation	Maintenance Mean	Maintenance Standard Deviation	Recovery Mean	Recovery Standard Deviation
MABP	94.96	12.25	91.45	14.49	85.51	22.07	87.50	18.01	89.62	9.37	90.54	11.27
RE	98	1	54	10	54	20	57	20	61	15	87	8
SE	89	3	45	10	50	19	54	19	58	14	79	6

One-way ANOVA

Table 5 - Test of Homogeneity of Variances

Parameter	Levene Statistic	df1	df2	Sig.
RE	21.549	5	234	.000*
SE	21.586	5	234	.000*

*P value < 0.05 is taken as significant

Table 6 - Percentage changes of MABP, RE and SE

Parameter	Baseline to Induction	Induction to Intubation	Intubation to Post Intubation	Post Intubation to Maintenance	Maintenance to Recovery
MABP	3.33	6.49	2.33	2.42	10.6
RE	44.8	0	5.55	7.01	42.6
SE	49.43	11.1	8	7.4	36.2

RESULTS

The mean RE values in the induction, intubation, post- intubation, maintenance and recovery phases are found to be 54±10, 54±20, 57±20, 61±15 and 87±8 (mean ± SD) which are significantly varying with the baseline 98± 1 (p value=.000) (as evidenced by tukeys and tamhanes tests)

The mean SE values in the induction, intubation, post- intubation, maintenance, and recovery phases are found to be 45±10, 50±19, 54±19, 58±14, and 79±6 (mean ± SD) which are significantly varying with the baseline 89±3 (p value =.000) (as evidenced by tukeys and tamhanes tests)

Out of 40 patients 25 are females, 15 are males. The RE and SE values are equally varying in both the sexes.

There is no significant impact of risk factors like DM or HTN. The RE and SE values are varying in all the phases as in normal individuals.

The percentage change in MABP in all the phases when compared to its baseline is less than the percentage change in RE and SE values except the induction to intubation phase in RE. This may be due to the short interval and smooth intubation and the change might have been taken into post intubation.

The percentage changes are as follows:

(MABP 3.33%,6.49%,2.33%,2.42% and 10.6%)

RE(44.8%,5.55%,7.01%,42.6%)

SE(49.43%,11.1%,8%,7.4%,36.2%)

DISCUSSION

With anesthesia the effects occur in the following sequence:

- Amnesia
- Unconsciousness
- Analgesia
- Skeletal muscle relaxation
- Autonomic responses [13]

If we are monitoring a patient by his cardio vascular status, we are doing it mostly by his blood pressure, which is an autonomic response whereas with entropy we are doing it on a more higher and sensitive plane which is advantageous both to the patient and the anesthesiologist.

Amnesia and Unconsciousness are cortical components

Antinociception Immobility Autonomic Stability are sub cortical components.

Therefore we are monitoring a cortical component which is more specific.

The induction drug dosage can be individualized

instead of administering the standard dosages as in some cases, observed during the study even with standard dosages the value is dropping down to single digits which means EEG is becoming a flat line.

[Flat EEG is equally critical as flat ECG]

During maintenance phase in most of the cases the entropy value is gradually   increasing, stating the awareness of the patient during surgery. But the patient cannot convey the message as he is intubated and is on continuous infusion of muscle relaxant.

If the patient's blood pressure starts raising during the procedure then the anesthetist is in a fix whether to administer an anti hypertensive or a hypnotic.

If entropy is monitored and if it is gradually increasing he can decide on a hypnotic rather than an anti hypertensive. If it is stable and the blood pressure is still increasing then he can decide on an anti hypertensive rather than a hypnotic.

Therefore this monitoring helps in avoiding the inadvertent usage of drugs.

During recovery phase, the dosage of the reversal drug can be individualized rather than giving the standard dosages with its own side effects.

Intubation and extubation can also be timed and planned basing on this value.

CONCLUSIONS

Entropy monitoring has been shown to reflect the different phases of anesthesia and can be used to titrate anesthetic drugs according to the individual needs of the patient minimizing perioperative complications and ensuring faster recovery in operating rooms and intensive care units.

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Influence of Yoga and Meditation on Academic Achievements of Medical Students in Physiology

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ABSTRACT

Background: Academic achievement is related with the quantity and quality of learning attained in students after a long period of instruction. It is an attained ability usually measured by standardized tests and expressed in grades. Several yogic studies have witnessed the improvement in academic performance. **Aim:** This study is carried out to assess the influence of yoga and meditation on academic achievements of medical students in physiology.

Materials and Method: The study started with 180 medical students who were segregated into three groups yoga (n=60), meditation (n=60), control (n=60). A yoga module consisting of yoga asanas, and meditation, was administered on experimental groups for 12 weeks. The academic performance was accessed by the summative marks in physiology before and after interventions in three groups at Annapoorana Medical college, Salem, India.

Results and Conclusions: Results suggest that Yoga and meditation group had significant change in academic performance in comparison to that of the control group. These results may be due to reduce stress, personality development, better attention and concentration achieved due to Yoga and meditation training.

Keywords: Yoga, meditation, stress, attention, Academic performance.

INTRODUCTION

The academic achievements in students is related with the quantity and quality of learning attained in them after a quit long period of instruction. Academic achievement is an attained ability or degree of competence usually measured by standardized tests and expressed in grades or units based on norms derived from a vide sampling of students performance. The major causes for the poor performance of medical students are many. The standard and methodology of premedical education is one of the mainly noted reason. Excessive stress also can affects students performance. Changes and improvement in academic performance has been reported in several yogic studies done in school children but very rare in college students especially in medical students. Yoga is a physical, mental and spiritual discipline, originated in India with a goal to attain a state of perfect spiritual insight and tranquility. It is the name given to a practice that helps create a union between the mind, body, and spirit[5]. Yoga has so many techniques that this investigation has been used two techniques (Asana techniques and Meditation techniques) of four essential yoga categories (1.Breathing techniques 2.Asana techniques 3.Relaxation techniques 4.Meditation techniques**).** A study aim the effect of simplified Kanadalini Yoga on personality development and academic achievement of students[7.] Regarding effect of meditation a study found that participation in transcendental meditation classes produced significant increases on intelligence and increased social self confidence, general psychological health, and social maturity[1]. Earlier findings suggest that yoga reduces stress in school children which enhances their academic performance[4]. Yoga has also been described as training in awareness which produces definite changes in academic achievements, perception, attention, concentration and cognition. Integrated approach of yoga that combines physical postures, pranayama and meditation together with the notional correction based on philosophy of yoga was found to improve both cognitive and motor functions.

Even though there are several research reports indicating positive impact of yoga and meditation on health there are limited research studies exploring effect of yoga on academic performance in college students. The present study examines the effect of yoga and meditation on the academic performance of physiology in medical students.

MATERIALS AND METHOD

One eighty medical students from first MBBS in the age group of (17-23) years, who were in self-reported good health were recruited for the study. They were all students of Annapoorana medical college, Salem. Tamilnadu, India. The project was approved by the institution's ethics committee of annapoorana medical college,Salem. The study protocol was explained to the participants and their signed consent was obtained. The study was designed in such a way that the participants were divided into three groups 1.Yoga group,(n-60) 2.Meditation group,(n-60) Control group,(n-60). Both Experimental and Control group were assessed on the first day and after 12weeks of the intervention. The subjects of experimental group were given yoga and meditation training, under the supervision of a yoga expert, for half an hour in the morning for a total period of 12weeks. The Control group did not undergo any yoga or meditation training during this period.

INTERVENTION

Yoga and meditation module were prepared by a yoga expert and the participants were given training on it for two days before the session began. Each Yoga and meditation session was conducted for 30 minutes, 5days a week, for 12weeks in the college premises. The Experimental Group practiced Yoga asanas (Physical Training) and meditation (mental training) in empty stomach. Each Yoga session was started with Suryanamaskar. The asana pose and duration are as follows- Suryanamaskar-4 minutes, Padmasana (lotus pose) -4 minute, Paschimottanasana (posterior stretching pose) -4 minutes, Padahastasana (boat pose) -4minutes, Super brain yoga- 1 minutes, vrikshasana (Tree stand pose)-1 minutes, Vajrasana (pelvic pose) -2 minutes, Sarvangasana (Shoulder stand pose)-4 minutes, Shavasana (Corpse pose) -6 minutes. Meditation sessions started with om chanting for 8 minutes, Follow own breathing 4 minutes, Concentrate on simple visual object-(Buddha) 4 minute, Practice visualization-create a new space 6 minutes, Do a body scan 8 minutes. Academic performance test was used as a pre-test and post-test for the experimental as well as control groups to assess the effect of yoga and meditation on the academic performance of the experimental group and to compare it with the control group, who never practiced yoga and meditation. The data collected was statistically analysed by SPSS version 20.

RESULT

Table1: Comparison of Academic Performance Before intervention

Group	Theory		Practical		Overall	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Control	51.22	14.241	33.57	7.041	84.78	16.931
Meditation	52.58	12.710	33.77	6.247	86.35	15.608
Yoga	52.90	12.718	33.48	5.809	86.38	15.729
F-value	0.274		0.031		0.193	
P-value	0.761		0.969		0.824	

Results in Table shows that F-values corresponding to theory (0.274, p=0.761), practical (0.031, p=0.969) and overall total (0.193, p=0.824) was found to be non significant at 0.05 levels as the p-values are greater than 0.05. This shows that there exists no significant difference in the academic performance in terms of theory, practical and overall total of the three groups before intervention.

Table 2: Comparison of Academic Performance After Intervention.

Group	Theory		Practical		Overall	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Control	49.95	13.639	32.78	6.143	82.73	16.198
Meditation	58.47	10.644	35.05	5.302	93.52	13.641
Yoga	61.20	8.967	35.73	4.602	96.93	11.385
F-value	16.320**		4.932**		17.105**	
P-value	< 0.001		<0.01		< 0.001	

**significant at $p < 0.01$ level

Comparison of academic performance after intervention among three groups was done by using one way ANOVA followed by Least Significant Difference (LSD) test and the results are given. This was done for theory, practical and overall academic performance separately. All the three F-values were found to be significant indicating that there exists significant difference among three groups. LSD results shows that there exists no significant difference in the academic performance among meditation group and Yoga group. However, academic performance of control group was significantly lower than that of meditation and yoga group.

Comparison of Academic performance before and after intervention in three groups.

The figure well indicate the difference in academic performance before and after intervention in experiment and control group.

DISCUSSION

This study investigated the influence of yoga and meditation on academic achievements of medical students in physiology. The result analysis shows that there is a significant improvement in academic performance of students who participated in yoga and meditation training when compared to control group. These results remain in coordinated with some of the earlier studies done in school students which found that yoga and meditation practiced over a period, can produces definite changes in perception, attention, concentration and academic performance, which can also manage anxiety and stress[2,3,6,8,9]. Here our study have proved it with medical students. It is very clear that when anxiety and stress is reduced, concentration, alertness, attentiveness and memory will improve. It is assumed that all these physiological and psychological changes by yoga and meditation have made the difference in the academic performance of the study group. Yoga and meditation also has impact on some important features such as the self confidence, self concept and so in mental health, therefore it can effect on academic performance. It means that one of the best strategies for improving the academic performance in medical students is by expanding the use of yoga techniques.

CONCLUSION

To minimize the psychological burden and to improve the academic performance of medical students, the addition of yoga program to the medical college curriculum could be a feasible option.

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Effect of Yoga on Perceived Stress and Reaction Time in Sedentary Males

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ABSTRACT

Background: Research studies have demonstrated the effect of yoga on physiological and psychological parameters. However, insights of yoga influence on central neural processing and psychological stress level are not much studied. Hence the present study was taken to assess the perceived stress score and sensory motor performance in sedentary men.

Materials and Method: 50 sedentary men belonging to the age group of 25-45 years were recruited. They were divided into control group (n=25) and study group (n=25). Study group participants underwent yoga training for 12 weeks. Stress level and reaction time (auditory and visual) were assessed before and after intervention (Yoga).

Results: The groups were comparable at baseline for stress level and reaction time. There was a significant difference in stress level, auditory reaction time and visual reaction time was significantly higher in study group comparing control group.

Conclusion: Yoga has got the beneficial effect on sensory motor performance (decreased auditory and visual reaction time) and reduces stress level.

Keywords: Reaction time, Yoga, Stress

INTRODUCTION

Cardiovascular disease accounts for 25% of death in low and middle-income countries [1], and it was predicted that by 2030 it would be the leading cause of death globally [2, 3]. Stress is one among the social factor which determines health [4]. Stress has been established to reduce working memory. Men are more susceptible to cardiovascular disease compared to females which might be due to lack of the coping mechanism to stressful situations [5] and thereby resulting in decreased work performance.

Yoga is an ancient science deals with asanas, breathing techniques and meditation. Many research studies have reported beneficial effects of yoga on physiological and psychological functions [6-11]. Life in this competitive world is stressful which could be the reason for stress-related disorders. Yoga is the best remedy for alleviating stress and its cost-effective method to deal with stress and stress-related disorders [12]. Few studies have found that practicing yoga can reduce stress level and reaction time (auditory/visual), reflects the sensory motor performance of an individual [13-15] However, the effect of 12 weeks yoga on perceived stress score and reaction time (auditory & visual) has not done in sedentary men. Hence, in the present study, we have planned to study the 12 weeks yoga influence on stress level and sensory-motor performance.

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MATERIALS AND METHOD

Participants

Consecutive, consenting self-reported 50 sedentary men in the age group of 25 to 45 years were recruited from the Pondicherry locality during the year 2015-2016. All the subjects were apparently healthy and gave written informed consent before the inclusion in the study. The nature and importance of the study were explained to the subjects. The study was done as a part of M.Sc dissertation under Tamil Nadu Physical Education and Sports University.

Parameters studied

Perceived Stress Scale (PSS): PSS is the most widely used psychological instrument for measuring the perception of stress. The questions in the PSS are of general nature, relatively free of content specific to any subpopulation group and enquire about feelings and thoughts to measure the "degree to which situations in one's life is appraised as stressful" especially over last one month. The items are easy to understand, and response alternatives are simple to grasp. Items are designed to tap how unpredictable, uncontrollable, and overloaded respondents find their lives. It comprises of ten items, four of which are reverse-scored, measured on a 5-point scale from 0 to 4. PSS scores are obtained by reversing responses (e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1 & 4 = 0) to the four positively stated items (items 4, 5, 7, & 8) and then summing across all scale items. Total score ranges from 0 to 40.

Reaction time: Reaction time is the time taken to respond to a sensory stimulus, which includes stimulus recognition, cognitive processing, and the motor response to the stimulus. Recognition reaction time (RRT) is a simple and inexpensive method for indirectly measuring the perceptual-cognitive processing capability of the central nervous system. Reaction time (auditory/visual) is recorded using digitalized reaction time apparatus (Anand agencies, Pune, India)

Experimental design

The study was formulated as simple, randomized control trial. On the day of recording, subjects were asked to report to our laboratory after overnight fasting (9-12 hr). They were asked to complete the PSS questionnaire and their reaction time (Auditory and Visual) were recorded. After baseline recordings, the subjects were randomized into two groups as follows - Experimental Group (n=25): Subjects were administered Yoga Therapy and Control Group (n=25): Subjects did not receive yoga therapy. 12 weeks of yoga therapy was given to study group alone in evenings. After the intervention period, all the parameters were again recorded in both the groups.

Intervention given

The subjects were detailed about the purpose and the procedure of the study. They were allowed to ask questions if they have any doubts. They were exposed to the recording instrument earlier and made comfortable by recording on them once. Then the final reading was taken. Yoga counseling was given before starting the yoga asanas. Procedure and benefits and contraindications of each posture were explained to them.

Yoga therapy which included Yogic counseling, lifestyle modification, hatha yoga, pranayama, and meditation. In yogic counseling, we introduced the subjects about the basic concepts in yoga. In life style modification, we suggested reduced dietary salt intake and fatty, junk food, Increased amount of raw vegetables and fresh fruits and aerobic exercise preferably walking for 30 minutes' minimum for at least three days a week. Hatha yoga practices included dynamic asanas concentrating on exhalation and increasing the Exhalation period for relaxation (Shavasana, Apanasana, Jatharaparivritti, Janusirasasana, Paschimottasana, and Uttanasana), Asanas to work on increasing Jataragni (Trikonasana and Jatharaparivritti) and asanas working on apana region to reduced accumulation of toxins (Apanasana, Uthkatasana and Mahamudra). Pranayama and Meditation were given mainly to reduce the stress.

Table 1: Training schedule

S.No	Name of the practice	Duration (min)
1	Shavasana	4
2	Apanasana	2
3	Jatharaparivritti	2
4	Janusirasasana	2
5	Paschimottasana	2
6	uttanasana	2
7	Trikonasana	2
8	Uthkatasana	2

Cont... **Table 1: Training schedule**

9	Mahamudra	2
10	Kapalabhati	5
11	Surya Nadi Pranayama	5
12	Anulom-Vilom Pranayama	5
13	Meditation	20
		Total – 40 minutes

Each session of yoga therapy took about 1 hour. Therapy was be given three days a week for 12 weeks, and subjects were motivated to practice the same daily at home.

Yoga training was given during evening hours six PM to seven PM at least four hours after the meals. Subjects were asked to wear loose fitting clothes for easy of movement during asanas. The training was given in a well-ventilated room.

Statistical technique

Data was expressed as Mean ± SD. Baseline comparison between control group and study group was done using unpaired Students' 't' test. Comparison of pre and post values was done using paired Students' 't' test. A p-value of less than 0.05 is considered as statistically significant. SPSS version 19 was used for analysis.

RESULTS
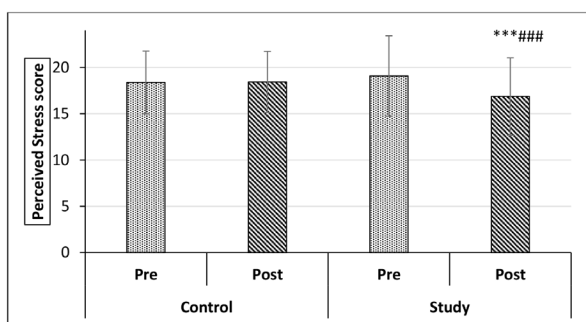
Figure 1: Comparison of Perceived Stress Score within and between the groups

Within group comparison was done using Student's paired t test. Between groups comparison was done using Student's unpaired t test. * Within group comparison - *p value < 0.05; ** p < 0.01; *** p < 0.001. # between group comparison - # p value < 0.05; ## p < 0.01; ### p < 0.001
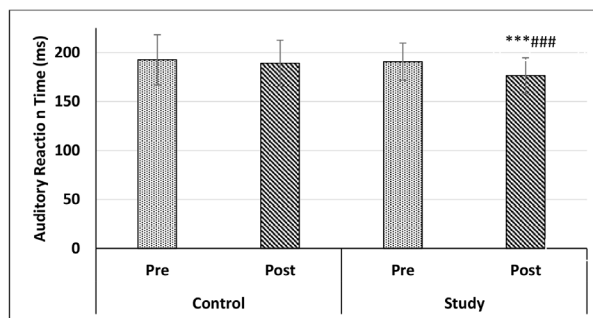
Figure 2: Comparison of Auditory reaction time within and between the groups

Within group comparison was done using Student's paired t test. Between groups comparison was done using Student's unpaired t test. * Within group comparison - *p value < 0.05; ** p < 0.01; *** p < 0.001. # between group comparison - # p value < 0.05; ## p < 0.01; ### p < 0.001
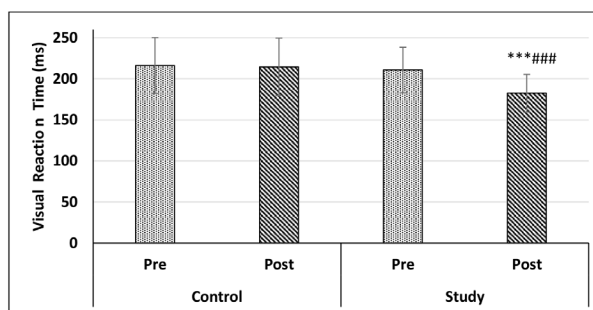
Figure 3: Comparison of Visual reaction time within and between the groups

Within group comparison was done using Student's paired t test. Between groups comparison was done using Student's unpaired t test. * Within group comparison - *p value < 0.05; ** p < 0.01; *** p < 0.001. # between group comparison - # p value < 0.05; ## p < 0.01; ### p < 0.001

There was no significant difference in PSS between control and study groups before intervention (Control: 18.38 ±3.39 vs. Study: 19.08±4.34, P > 0.05) (Figure 1). There was no significant difference between control and study group in baseline auditory (ART) (Control: 192.60±25.66 vs Study: 190.69±19.00, P > 0.05) (Figure 2) and visual reaction time (VRT) (Control: 216.30±34.00 vs Study: 210.82±27.63, P > 0.05) (Figure 3). Also, VRT was significantly longer than ART.

There was a significant reduction in PSS score after the study period in the study group (Control: 18.44

±3.29 vs Study: 16.86±4.19, p<0.001) (Figure 1) as well as both auditory (Control: 189.23±23.55 vs Study: 176.41±18.36, p<0.001) (Figure 2) and visual (Control: 214.58±34.94 vs Study: 182.58±22.89, p<0.001) (Figure 3) reaction time in study group subjects as compared to the control group.

DISCUSSION

In the present study, we found a significant reduction in stress level and, reaction time (auditory and visual reaction time) among study group participants who underwent 12 weeks yoga practice session comparing control group. These findings of our study are in line with Satyapriya et al. who demonstrated reduced perceived stress among pregnant women [16] and Michalsen A et al also have reported reduction in stress in mentally distressed women [17], following yoga training and literature have demonstrated reduced reaction time following yoga training [14, 18].

Yoga is an ancient science which includes meditation, asanas, kriyas, and breathing techniques. Meditation improves GABA, a neurotransmitter in the prefrontal cortex which helps for better cognition and attention [19]. Meditation also increases the alpha waves in the brain which appears during relaxed state [20]. The meditators have shown reduced anxiety level [21, 22] which suggest that the calming effect of meditation could have possibly contributed to the reduction in reaction time (auditory/ visual) and thereby, improving the sensory-motor performance.

Stress involves multiple mechanisms to cause derangements in physiological or psychological homeostasis [23]. The baseline values of reaction time (auditory & visual) in our study may be due to chronic stress which is known to increase cortisol levels causing repeated activation of the HPA axis and finally leading to decreased autonomic activity causing impairment of cognition. The other reason for this adverse impact of stress on cognition could be due to circulating glucocorticoid level that prevents the uptake of glucose by hippocampal neurons [24]. Further, chronic stress is the major proposed mechanism for hippocampus susceptibility for neurotoxic tasks [25] which could have impaired the executive function involving motor skills (reaction time).

Taken together, the reduction of reaction time and stress levels following yoga intervention would have resulted from improved wakefulness, awareness and mental processing [26] as a result of frequent relaxation technique.

We observed a significant reduction in perceived stress score (PSS) in study group comparing control group following the intervention (yoga) which might be achieved by integrating reduction in cortisol level, HPA axis activation, and sympathetic nerve firing.

CONCLUSION

Our observations suggested that yoga reduces reaction time and reduces the stress level among sedentary men.

Conflict of Interest: None

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Effect of Balasana on Pulmonary Function Tests among Healthy Medical Students

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ABSTRACT

Introduction: MBBS is one of the toughest courses in the world, where students are busy with studies throughout the course. They have less chances of relaxation. Asanas and pranayama are two limbs of ashtanga yoga of patanjali which help individual to integrate mind and body. Yoga helps to lower blood pressure, increase lung capacity, improve respiratory function and heart rate, boost circulation and muscle tone .Many medical colleges in world already introduced stress relieving program. In yoga there are a set of postures to do. If medical students are asked to do whole asanas it will be inconvenient for them to practice every day due to paucity of time. Present study focuses exclusively on one asana that can be incorporated in medical student's busy schedule. Balasana is a simple relaxation position. Combined with proper regulation of breath balasana is supposed to soothe the mind. This simple asana can be introduced in regular MBBS curriculum.

Objectives To study the effect of balasana on pulmonary function test among healthy medical students. To compare the effect of balasana among study and control groups

Materials and Method: Study included 100 medical students, who were selected by volunteer participation and divided into study group (those who do only balasana) and control group (those who lead sedentary life without doing any asanas). Pulmonary function test was carried out, parameters like FEV_1, FVC, PEFR, FEF_{25-75} were measured using HELIOS.

Results: It was found that there is no significant improvement in parameters in pulmonary function test

Conclusion: Results of our study showed that balasana has no effect on pulmonary function tests.

Keywords: Yoga; Balasana; Pulmonary Function tests.

INTRODUCTION

MBBS is one of the toughest courses in the world,[1] where students are busy with studies throughout the course. There is a high level of stress and anxiety among medical students[2] which is leading to higher incidents of suicidal attempts. [3] Many medical colleges in world already introduced stress relieving program. Asanas and pranayama are two limbs of ashtanga yoga of patanjali which help individual to integrate mind and body.[4] Yoga helps to increase lung capacity, improve respiratory function and muscle tone .[5] Studies showed that regular yoga practice reduced stress levels and also reduces stress in the morning hours of exam.[6] Yoga improves pulmonary function tests.[7,8] Yoga is a practical discipline incorporating a wide variety of practices whose goal is the development of a state of mental and physical health, well-being and inner harmony.[9] It focus on isometric exercise and stretching unlike aerobic exercises and

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includes meditation, regulation of breathing, physical exercises and postures.[10] Yoga helps in sympathetic-parasympathetic balance by reducing sympathetic activity and activating parasympathetic system.[11,12]Yoga improves respiratory functions, balances activity of antagonistic muscle groups and slows dynamic and static movements.[13] Even in asthmatic patients if yoga is adjunctively used with pharmacological interventions lead to significant improvement in pulmonary function which include increase in peak expiratory flow rate (PEFR), vital capacity (VC), forced vital capacity (FVC), forced expiratory volume in 1st sec (FEV1), maximum mid expiratory flow rate(MMFR).[14, 15,16] In yoga there are a set of postures to do. If medical students are asked to do whole asanas it will be inconvenient for them to practice every day due to paucity of time. Present study focuses exclusively on one asana that can be incorporated as a day to day activity in medical student's busy schedule. Balasana or child pose is a simple relaxation position.[17] Combined with proper regulation of breath balasana is supposed to soothe mind. This simple asana can be introduced in regular MBBS curriculum. Several studies are conducted on effect of yoga on pulmonary function tests.[18,19] But there are only few studies conducted on effect of individual asanas on these parameters. In the present study pulmonary function tests including FVC, FEV1, FEV1/FVC, PEFR, FEF $_{25-75}$ is estimated after a period of balasana practice for 90 days. The present study was undertaken to study the effect of individual simple relaxing asana like balsana on pulmonary function tests (PFT).

MATERIAL AND METHOD

Participants

The current experimental study included 100 male and female participants after obtaining voluntary informed consent. The study protocol was approved by institutional ethical committee of A.J Institute of Medical Sciences and Research Centre, Mangalore. The following inclusion and exclusion criteria was used for selection of the participants.

Inclusion Criteria:

Apparently healthy, wiling medical students of age group 17-25 years were included in the study.

Exclusion Criteria:

Participants with Acute respiratory illness, Participants on any form of respiratory medication, Congenital heart disease, Epilesy, any injury or immobilization, Spinal deformities, Ankle problems, eye or ear infections, Pregnancy, habit of smoking, practicing yoga for past 6 months.

After selecting the participants, they were randomly grouped into control and study groups with 50 participants in each group respectively. The study group practiced balasana for 90 days. Pre and post parameters were collected from both control and study group.

Balasana training

Training was under the supervision of Yoga therapist.

To perform Child Pose (balasana) [17]

Select a clean area. Kneel on a mat with two great toes touching, heels spread out and buttock resting on the heels. Keep chest and back straight and put the arms [20] forward and let the palm rest on the distal part of the thighs or on knees. Raise the hands above with arms touching ears and elbows straight. Start exhaling and bend the body gradually forward with stomach touching thigh and forehead and palm touching the ground. Keep both the arms backwards in a stretched condition with palms facing upward. Slowly start inhaling and lift head, body and arms gradually. Come back to original position. Repeat this cycle for 10 times. Then sit in the original posture. Close the eyes lightly and try to visualize an object behind the lower end of sternum. Then slowly inhale and exhale through the object and allow it to happen naturally. Stay in this position for 5 minutes. Then bend forward resting on right hand and release the knees. All the parameters were measured on day 0 and then every 15 days till day 90. Parameters were taken from both study and control group.

Respiratory parameters

a) Vital capacity in litres (FVC).

b) Forced expiratory volume at the end of first second in litres (FEV_1).

c) Forced expiratory volume at the end of first second in litres (FEV_1)/Forced vital capacity. (FEV1/FVC)

d) Peak Expiratory flow rate (PEFR)

e) Forced Expiratory flow 25-75 (FEF25-75)

All these pulmonary functions were measured using RMS HELIOS (a self calibrating computerized spirometer that fulfils the criteria for standardized lung function tests) available at the Department of Physiology, A J Institute of Medical Science and Research Centre, Mangalore. Subjects were asked to relax, then take a 30 deep breath and then to blow hard into the mouthpiece of the flow meter with a sharp blast and then again to take deep inspiration (nose was closed with nose clip). Two recordings were taken at one-minute interval and best of two was selected.

Statistical analysis: Data was analysed by using spss 22.0 version. To compare the significance of difference paired t test was applied. The significance level was accepted at $P<0.05$.

RESULTS

A randomized controlled study consisting of 100 medical students of AJIMS, divided into study group (who undergo balasana training) and control group (who do not undergo balasana training and is living a sedentary life) was undertaken to study the effect of balasana on pulmonary function test. Pulmonary function tests (FVC, FEV_1 /FVC, PEFR, FEF_{25-75}) of each subject were recorded at baseline and then every 15 days till day 90.

Table 1: Demographic characteristics of control and study group

	Study (n=50)	Control (n=50)
Age (yrs)	18.26±0.63	18.06±0.59
BMI	23.48±4.31	24.31±2.91

Data was presented as mean ± SD

Table 2: Gender distribution of subjects studied

	Study group	(n=50)	Control group	(n=50)
	No	%	No	%
Male	21	42	21	42
Female	29	58	29	58
Total	**50**	**100**	**50**	**100**

Data was presented as frequency and percentage.

Table 3: Comparison of day 0 and day 90 PFT in control group (n=50)

Parameter	Day 0 mean ± SD	Day 90 mean ±SD	P value
FVC(L)	2.84±0.54	2.84±0.54	0.966
FEV_1(L)	2.54±0.45	2.54±0.45	0.911
PEFR(L/S)	5.56±1.33	5.56±1.32	0.793
FEF(L/S)	3.40±0.84	3.41±0.84	0.785
FEV_1/FVC(%)	89.67±3.49	89.66±3.54	0.846

*P<0.05 is significant

Table 4: Comparison of day 0 and day 90 PFT in study group (n=50)

	Day 0 mean±SD	Day 90 mean±SD	P value
FVC(L)	3.25±0.68	3.21±0.58	0.621
FEV_1(L)	2.82±0.50	2.84±0.49	0.318
PEFR(L/s)	6.36±1.60	6.35±1.58	0.595
FEF(L/s)	3.73±0.93	3.74±0.92	0.307
FEV_1/FVC	88.24±3.52	88.42±4.00	0.410

*P<0.05 is significant

DISCUSSION

Health of medical student is a topic of great concerned. For mental and physical recreation extracurricular activities like yoga is a must.[21] Balasana is one of asana in Yoga which is a relaxing posture. The present study was conducted to evaluate the effect of balasana on pulmonary function test among healthy medical students.

Till date lots of studies have been conducted to find out relation between yogic postures and PFT. But there are only few studies that conducted on a specific yogic postures and PFT. To our knowledge this is the first study examining the effect of balasana on pulmonary function tests.

In our study there was no significant change in pulmonary function tests in study group after practicing for 90 days. Even though Bhattacharya and Krishnaswami observed [22] that yoga intervention has less physical and physiological changes Raj kumar yadav and shoba das[23] in their study found such interventions increased FVC, FEV_1 and PEFR. Similarly, Prakash etal[24] in their study found significant difference only in PEFR in yogis while Dee Ann Birkel and Lee edgren[25] observed and stated that yogic asanas alone is not the cause for improvement of vital capacity. In a study conducted by Kaushik Halder etal [26]among BSF personnel yogic practices didn't change FVC and FEV_1 values significantly. Respiratory system uses many muscles for the movement of thoracic cage. Regular yogic practices can help in the improvement of total pulmonary function by increasing efficiency and performance of these muscles and movements.[27] Effect of pranayama include release of lung surfactant that helps in increasing total lung capacity.[28] Appropriate yogic breathing manoeuvres can improve pulmonary muscular strength and efficiency , which can ultimately help in the improvement of lung volumes and capacities.[29] Balasana as such is not causing stretching of chest muscles. So don't improve PFT. From above statements it can be postulated that practicing balasana is not improving pulmonary function, probably because balasana is not stretching chest muscles so that do not increase performance of these muscles. It can be postulated in balasana upper ribs move while lower part of chest is compressed. Postulated effect of Balasana may be in ventilation-perfusion ratio (V_A/Q) in upper airway zone. While performing Balasana upper airway zone ventilation and perfusion may increase for which ventilation perfusion studies are needed.

CONCLUSION

In the present study we have not observed significant changes in the pulmonary function tests of intervention group. We recommend further detailed study in this area to explore and confirm therapeutic effects of balasana.

Limitations

The major limitation in this study is low sample size. Further, results may not be generalized as the study was conducted at one centre.

Conflict of Interest –Nil

Source of Funding- Self

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Influence of Menstrual Cycle on Pulmonary Function Tests in First Year Female Medical Students

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ABSTRACT

Background: The physiological changes in the levels of various hormones during different phases of menstrual cycle not only affects reproductive system but also affect various other functions in the body. **Aims and Objective:** To demonstrate the variations in pulmonary functions tests during different phases of the menstrual cycle. **Materials and Method:** This observational study was conducted on the selected first year female medical students of mediciti institute of medical sciences, ghanpur, Hyderabad, telangana India. Sixty first year female medical students who were admitted to the course with a regular menstrual cycle of 28 ± 3 days were selected. We measured various pulmonary function tests on three different phases of menstrual cycle (menstrual phase, 1-4 day); (proliferative phase, 6-13 th day); and (secretory phase, 14-28 th day). **Result:** In the values obtained from pulmonary function tests, forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) showed an increase in the mid-secretory phase ($p < 0.001$); FEV1/FVC ratio was elevated in the mid-secretory phase ($p = 0.026$); and peak expiratory flow rate (PEFR) also showed an increase in the secretory phase ($p = 0.001$). These parameters were low in menstrual phase and decreased in the proliferative phase when compared with the secretory phase. **Conclusion:** This study was aimed as an effort to analyse, how the regular dynamic changes occuring during different phases of menstrual cycle influence pulmonary function tests parameters, in normal healthy female subjects because some large epidemiological studies suggest that lung functions fluctuates during the menstrual cycle.

Keywords: Menstrual Cycle,Lung Function Tests,Female Medical Students

INTRODUCTION

The dynamic variations in the levels of various female sex hormones during the different phases of the menstrual cycle affect various systems in body, apart from the reproductive system. progesterone plays an important role causing relaxation of smooth muscles resulting in a decrease in contractility of respiratory muscles affecting the lung functions have been reported[1]. There are only few studies from india on pulmonary function tests in different phases of menstrual cycle and the studies which were done also reported contradictory results on pulmonary functions in different phases of menstrual cycle. Some noted changes in secretory phase while others did not notice any effect on pulmonary functions in different phases of menstrual cycle[2]. Also some studies say exacerbations in asthma more in females than in males[3]. keeping in view of the above we planned to assess the pulmonary function tests during menstrual, follicular and secretory phases of menstrual cycle in healthy female medical students.

MATERIALS AND METHOD

This observational study was conducted in the research laboratory, Department of Physiology, Mediciti institute of medical sciences, ghanpur,medchal, R.R District,Telangana,India, after obtaining the clearance from the local ethical committee of mediciti institute of medical sciences, ghanpur. This study was carried during the years 2015 and 2016, in healthy female

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first year undergraduate medical student volunteers aged between 18 and 20 years with a history of normal menstrual cycles of 28 to 32 days. The oral and written informed consent was obtained from the subjects after explaining thoroughly the protocol of the study. Girls with a history of chronic pulmonary illness or those on long term medication which has a bearing on pulmonary functions were excluded from the study .A detailed self designed questionnaire was used to assess regularity, pattern of menstrual cycle or any allergies which can cause respiratory disease. After thorough preliminary clinical examination of the respiratory system, the pulmonary function tests ,FVC,FEV1,FEV1/FVC RATIO were conducted by using RMS HELIOS.401 SPIROMETER in sitting position. .Before the tests ,the subjects were made familiarized with the machine and detailed instructions and demonstrations done to the thorough satisfaction of the subjects. The age, weight, and height of the subjects were recorded and all the samples were taken between 10 a.m. and 12.30 pm. The tests were performed after 10 minutes of non ambulation and during different phases of their cycles,i.e menstrual phase(1-4 day),proliferative or follicular phase(6-13 day) and luteal or secretory phase(14-28 day).The respective phases of mensrtruaton were calculated from the first day of last menstrual cycle. After taking deep breadth the subjects exhaled forcefully in the tube closing the nostrils. For each subject the procedure was repeated thrice after a gap of 2to 3 minnutes and best of the three values taken. The results were taken in liters per minute.

Statistical Analysis : with the data obtained, mean ± SD (standard deviation) was calculated. The groups during different phases were compared by statistical test of variance i.e one-way ANOVA. The mean difference between the groups done and p value calculated. A p value less than 0.05(p < 0.05) was considered significant statistically.

FINDINGS

The pulmonary function tests parameters of each subject were measured at menstrual phase (1to4day), proliferative phase (6to12th day), and secretory phase (22 or 23rd day) and analysed statistically. The parameters obtained at three different periods (menstrual phase, proliferative phase, and secretory phase) are given in **Table 1.** When compared to proliferative and secretory phases ,the measures of pulmonary function tests were less in menstrual phase. Even in the mean values calculated, the values in menstrual phase were lower in comparision to proliferative and secretory phases. Anova showed significantly different(p< 0.05,or p <0.01, or 0.001)FVC,FEV1,PEFR andFEV1/FEC when the mean values calculated in each pulmonary function tests between the three groups. The mean FVC, FEV1, and PEFR were significantly different and higher (p < 0.05, or p < 0.01, or p < 0.001, respectively) in both proliferative and secretory phases in comparision with the menstrual phase as shown **in (Table2)** .The mean FEV1/FVC ratio was significantly (p < 0.05) different and higher in the proliferative phase than in the menstrual phase.

TABLE:1 Parameters of pulmonary function test (mean ± SD, n = 55) at three different phases of menstrual cycle in first year female students

parameters	menstrual phase	proliferative/ follicular phase	Secretary/luteal phase	F(DF)	P value
FVC (L)	2.69+_ 0.42	3.04±0.41	3.04±0.41	8.78	<0.001
FEV1 (L)	2.39±0.84	2.72±0.42	2.72±0.42	7.59	0.001
PEFR (L/s)	5.79±1.5	2.72±0.62	6.59±0.62	10.11	<0.001
FEV1/FVC (%)	91.35±7.00	94.80±6.61	94.80±6.61	3.69	0.025

TABLE 2:comparision (p value) of mean difference between the groups for each parameter

COMPARISION	FVC	FEV1	PEFR	FEV1/FVC
Menstrual phase vs proliferative phas	0.003	0.011	<0.001	0.018
Menstrual phase vs. secretory phase	<0.001	0.001	0.001	0.625
Proliferative phase vs. secretory phase	0.700	0.685	0.756	0.180

DISCUSSION

The study was done to evaluate the influence of the menstrual cycle and the effect of female sex hormones on pulmonary function tests parameters during the three phases of menstrual cycle in healthy female first year medical students. There are only few studies in india on pulmonary function tests in different phases of menstrual cycle. Majority of the studies have evaluated the effects on the follicular and luteal phases without any evaluation done on the menstrual phase. The results in our study showed that FEV1 and FVC values elevated in the secretory phase and also the FEV1/FVC ratio higher in mid secretory phase[4,5]. Also possible role of progesterone on pulmonary function tests as a stimulant, causing hyperventilation in the secretory phase of the menstrual cycle cannot be ruled out[4,5]. our statistical findings are also consistent with study conducted by resmi etal [6]. Our study showed high FEV/FEV1 ratio on par with the study done by Hebbar etal[7]The mechanisms underlying the role of progesterone is through the hypothalamus, progesterone receptors, and also through the neuronal mechanisms.[8]

Limitations of study : serum levels of female sex hormones during menstrual cycle were not measured due to practical difficulties.

CONCLUSION

The results obtained in the study reveals better performance of pulmonary functions in the secretory phase than the proliferative and menstrual phases. The possible role of progesterone as a stimulant cannot be ruled out. However it requires further evaluation of female sex hormones to enable the physicians to formulate better treatment .

Conflict of Interest: The authors declare they have no conflict of interest.

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Comparison of Physical Fitness Index and Maximal Aerobic Capacity Pre and Post Stair Case Climbing

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ABSTRACT

The current study looks into comparison made in cardiovascular functional abilities of students before and after eight weeks staircase climbing. 60 medical students of age group 18-25 years of tertiary health centre of Municipal Corporation of Greater Mumbai were included in the study. Regular stair climbing exercise induces significant adaptations both at rest and during exercise in a variety of factor like heart rate, blood pressure, physical fitness index and maximal aerobic power. These changes suggest significant increase in cardiovascular fitness after training of stair climbing for 8 weeks. As fitness levels improve, the body functions more efficiently and the heart can better withstand the strains of everyday stress.

Keywords : *Physical fitness Index, Aerobic Capacity, Stair case climbing.*

INTRODUCTION

The human body is extremely resilient during youth-not so during middle and old age. The power of prevention and nonetheless is ours; it enable us to make healthy lifestyle choices today that will prevent diseases in future and increases quality and length of our life.[1] Fitness is the ability to function efficiently and effectively to enjoy leisure, to be healthy to resist disease and to cope up with emergency situations. Endurance is the ability of body to withstand the stresses set up by prolonged activity. Regular physical activity will improve both cardiovascular endurance and muscular endurance.

Cardiovascular Fitness-The ability of the body to perform prolonged, large-muscle, dynamic exercise at moderate to high levels of intensity. This is dependent on the ability of the heart and lungs to deliver oxygen to the working muscles. Physical activity is miracle medication that people are looking for. It makes person look and feel younger, boosts energy, provides lifetime weight management, improves self confidence and self esteem, and enhances independent living, health, and quality of life.[1]

Aerobic capacity- is defined as "the maximum amount of oxygen the body can use during a specified period, usually during intense exercise." It is a function both of cardio respiratory performance and the maximum ability to remove and utilize oxygen from circulating blood. To measure maximal aerobic capacity, an exercise physiologist or physician will perform a VO_2 max test. VO2 max or maximal oxygen uptake is one factor that can determine capacity to perform sustained exercise and is linked to aerobic endurance. It is generally considered the best indicator of cardio respiratory endurance and aerobic fitness.

Stair climbing type of new fitness trend developed which lead to increase participation in fitness program. Cardiovascular fitness is one of the most important health component required for doing more physical work . Thus people need to undergo an aerobic exercise program of an appropriate intensity in order to reach and maintain a desired level of physical fitness. Stair climbing can be fun and effective if you learn to do it with patience and safety. Do not be hasty about achieving the results. Be sincere and practice stair climbing like any other habit you cannot get rid off.

The current study looks into comparison made in cardiovascular functional abilities of students before and after eight weeks staircase climbing. In this study 60 medical students (female=30 and male=30) of age group 18-25 years of tertiary health centre of Municipal Corporation of Greater Mumbai were taken.

MATERIALS AND METHOD

The current study looks into comparison made in cardiovascular functional abilities of students before and after eight weeks staircase climbing. In this study 60 medical students(female=30 and male=30) of age group 18-25 years of tertiary health centre of Municipal Corporation of Greater Mumbai were taken.

RESULTS

As shown in the table no. I, there were no significant difference between groups for age, weight. Resting heart rate was significantly higher in pre training than post training (p < 0.05).Resting blood pressure was also higher in pre training than after eight weeks of training.Table 4 . Relative to pre training, post training the stair climbing group showed a significant increase in VO_2MAX (p<0.05).

Table 1: COMPARISON BETWEEN PARAMETERS USED IN STUDY IN PRE AND POST TRAINER GROUP.

	Pre training n=60 mean±SD	Post training n=60 mean±SD	P value
Age (years)	18.15 ±.444	18.15±.444	> 0.05
weight(Kg)	58.20±10.914	57.98 ±10.640	> 0.05
Systolic pressure(mm Hg)	127.33±2.199	120±.902*	<0.05
Dystolic pressure(mm Hg)	84.53±2.439	80.17±.763*	<0.05
Heart rate (Beats/min)	81.88±5.705	73.17±4.279*	<0.05
PFI	76	92	<0.05

* significant

Table II: Physical fitness index: CHI –SQUARE TEST

Chi-Square Tests			
Pearson Chi-Square	Value	df	Asymp. Sig. (2-sided)
	60	2	0.000

Table III: PFI CATEGORY-WISE DISTRIBUTION OF PRE AND POST TRAINING.

PrePFI	Count	Column N %	postPFI	Count	Column N %
<55 (poor)	0	.0%	<55 (poor)	0	.0%
55-79 (average)	52	86.7%	55-79 (average0	7	11.7%
80-90 (good)	8	13.3%	80-90 (good)	52	86.7%
>90 (excellent)	0	.0%	>90 (excellent)	1	1.7%
Total	60	100.0%	Total	60	100.0%

TABLE IV: COMPARISON BETWEEN VO$_{2MAX}$ STUDY IN PRE AND POST TRAINER GROUP.

	PRE VO2 MAX Mean ± SD	POST Mean ± SD	P VALUE OBTAINED
MALE	47.3±1.5	59.28 ± 1.7	<0.05
FEMALE	37.3 ± 1.8	45.12 ± 2.1	<0.05

* significant

DISCUSSION

New fitness trend has gradually developed in fitness and wellness programmes. Aerobic or cardiovascular fitness is important in rapid industrialization through mechanization and automation in developing countries. So from view point of ergonomics it is an important task to assess the Physical Fitness Status of Indians because better fitness will lead to better performance. Thereforeeach individual needs to undergo an aerobic program of appropriate intensity in order to reach human power in most economical way.

Many research in exercise physiology has lead to develop tests and procedure to find out physical fitness. But the need for simple test based on observations during work stress has been recognized.

Aerobic exercise as "any activity that uses large muscle groups, can be maintained continuously, and is rhythmic in nature." It is a type of exercise that overloads the heart and lungs and causes them to work harder than at rest. The important idea behind aerobic exercise today, is to get up and get moving!! There are more activities than ever to choose from, whether it is a new activity or an old one. Find something you enjoy doing that keeps your heart rate elevated for a continuous time period and get moving to a healthier life. With oxygen – to produce energy. Uses fat as main energysource. Movement is rhythmic, continuous and sustained. The activity continues beyond 5 minutes. Oxygen from Kreb's cycle is required to manufacture ATP. Hence termed as aerobic activity.This stair climbing study is the first to show an improvement in cardiorespiratory fitness using VO$_2$MAX, regarded as the gold standard in fitness assessment

The fitness level was assessed from two measures like physical fitness index and maximal oxygen uptake of students using Harvard's step test

Researchers like Bandyopadhyay and chattopadhyay[6] found average category PFI in 65% of college students. Study conducted by Ganeriwal and khandare[7] found poor PFI in medical students using Hardvard step test. In current study 86% students has good PFI after stair climbing exercise for 8 weeks which was just 13% before exercise (Table III)

Fitness status of students when they were taken in study was improved very much after stair climbing. The post exercise have a significantly higher PFI score than the pre exercisers. The results of this study have indicated statistically significant difference in physical fitness index (PFI) in the case of the pre and post exercise conditions.

Aerobic endurance training decreases blood pressure through a reduction of vascular resistance, in which the sympathetic nervous system and the renin-angiotensin system appear to be involved, and favorably affects concomitant cardiovascular risk factors.[8]

The results of this study are similar to the results found out by Whelton[9], Kingwell and Jennings.[10] The decrease in blood pressure is connected to aerobic exercise, which causes better cardiovascular adaptations. The influence of the exercises on blood pressure varied according to the intensity and duration of individual workouts.[10]

The effects of the applied physical activity i.e. stair climbing on resting heart rate have led to a more economical heart functioning. it is also seen that Mean value of resting heart rate is lower in students after 8weeks of exercise as compared to before and they are statistically significant (p <0.05).(table : I)similar results were found instudies of Keen E. N. and Sloan A. W.[11]

In present study short-term stair-climbing program can confer considerable cardiovascular health benefits on previously sedentary young subjects, lending credence to the potential public health benefits of this form of exercise. Similar results were found in study ofBoreham CAet al[12] (2000) , E D Shenassaet al[13],Boreham et[14] al. (2005), J. Ilmarinen and co-worker[15] , Loy SF and collegues[16], F. A. Oldenburg and coworkers[17].The better fitness of the study group of students is due to the regular physical activity in the form of climbing. Astrand (1956)[18], Banerjee(1970)[19] and Sen (1973)

[20] have shown Inverse correlation of Resting Heart Rate and Resting Blood Pressure with Physical Fitness Index(PFI).

VO_{2max} serves as an objective indicator of overall physiologic functional capacity and aerobic fitness. The dynamic circulatory response is directly related to the intensity of the work load and presents a linear increase in oxygen consumption in relation to a progressive increase in the intensity of exercise up to $VO_{2max.}$ [21]

Regular aerobic training induces significant adaptations both at rest and during exercise in a variety of dimensional and functional capacities related to the cardiovascular and respiratory regulation system, enhancing the delivery of oxygen into active muscles. These changes include decreases in resting and submaximal exercise HR, enhanced stroke volume and cardiac output, an increasing arteriovenous oxygen difference and reduction in Pulmonary minute ventilation during submaximal exercise. With an adequate training stimulus, most of these responses are independent of race, gender and age. The mean improvement in maximal aerobic power has generally been about 15 to 25% of the baseline values over the first 2 to 3 months of regular aerobic training. However, substantial heterogeneity in the responsiveness to aerobic training, assessed by the change in VO_{2max}, has been observed even in highly standardized training programs. The mean improvements of VO_{2max} have been about 25% with a range 0% to a 40% increase in VO_{2max}.[21,22,23,25]

In present study post exercise have a significantly higher predictedVO_{2max}.than the pre exercisers. The results of this study have indicated statistically significant difference in VO_{2max}.in the case of the pre and post exercise male and female groups.Beneficial changes in VO_2MAX have repeatedly been reported for exercise training programmes, typically of the range 5–30%.[24]

Study conducted by Glassford et al[26] compare VO_{2max}.by predicted and actual methods in males by using four test methods. In James Vogel 1986 study of VO_{2max}.analysis in US population got VO_{2max}.by direct method using Douglas bag of technique on treadmill.[27]

In present study the co-efficient correlation between physical fitness index and maximal aerobic power in pre and post training stair climbing exercise was positive. Positive co-efficient correlation was statistically significant. Similar correlation study was done by Hettinger et al[30] and studies correlating different fitness test and VO_{2max}. were also done by reserchers.[28,29,30,31]. These result suggest that step test gives as good as estimate of VO_{2max} as that obtained with a tredmill. Keeping in view the various advantage of step test over tredmill.Its use could preferred compare to tredmill. Some of advantages of step test are simplicity, rapidity, reliability and portability.

CONCLUSIONS

Regular stair climbing exercise induces significant adaptations both at rest and during exercise in a variety of factor like heart rate, blood pressure, physical fitness index andmaximal aerobic power. These changes suggest significant increase in cardiovascular fitness after training of stair climbing for 8 weeks. As fitness levels improve, the body functions more efficiently and the heart can better withstand the strains of everyday stress.ThusStaircase climbing at stretch is an aerobic type of exercise.

CONCLUSIONS

As the BMI increases, the AHI increases.

Neck circumference was found to be a good predictor of OSA =44% COPD patientsRE

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A Cross-Sectional Study of Colour Vision Testing Between Medical Students of Indian and Malaysian Medical Colleges, at Belagavi

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ABSTRACT

Introduction: The world is colorful, the appreciation of color is very essential for our smooth daily activities. Significant number of peoples suffers from color vision defect but most of the time it remains an unnoticed problem.

Objectives: To study the prevalence, "Gender difference" and involvement of "Ethnicity" factor in Colour vision defects among medical students.

Materials and Method: Includes 100 Indian medical students from Belagavi Institute of Medical Sciences (BIMS), Belagavi and 100 Malaysian medical students of USM-KLE, International Medical Programme (USM-KLE) Belagavi, of all the five phases, who were tested for presence of Colour vision defects with the help of Ishihara's Pseudoisochromatic chart and Edridge Green Lantern test.

Result: Showed that, in BIMS medical students out of 100, 0% of the students were colour deficient, whereas in USM-KLE medical students out of 100, 2% of male medical students showed Green colour blindness.

Statistical Analysis: Done by using Chi-square test.

Conclusion: The study concludes that, the prevalence of Colour vision defects was, 2% of male medical students of USM-KLE had Green colour blindness, indicating that males are more affected than females, which could be due to genetic predisposition, ethnic variations, congenital and acquired colour vision defects.

Keywords: Colour vision defects, Medical students.

INTRODUCTION

The lash green wide fields, the brilliant colors of the flowers and butterflies, the gorgeous blue of the sea, the majestic colorful horizon during sunrise and sunset gives immense pleasure to our eyes.

Various professions require normal color vision. Anyone who is color blind should be advised against

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training for occupations like pilots, certain jobs in armed forces and electrical jobs etc. Especially medical students, students of health sciences and medical/dental practitioners, who lack this faculty partially or totally, experience a wide range of difficulty in their practice. It is very difficult for Doctors and health professionals to appreciate and evaluate the presence and extent of colored clinical signs e.g. fresh blood in vomitus or stool, colored structure of bacilli in sputum stained by Ziehl-Neelsen method or biopsy sample stained by H-E stain. They must be made aware of their deficiencies and know their severity so that they can take special care in

clinical practice.

Color blindness is an abnormal condition characterized by the inability to clearly distinguish different colors of the spectrum. Human color vision is normally Trichromatic that is, the mixture of red, green and blue lights[1]. For the perception of color, the synergistic and harmonic functions of retina, different parts of the thalamus and cerebral cortex are essential.

Sir John Dalton was the first scientist to give a clear description of his own color blindness in 1794. His publication subsequently stimulated much research into the pathophysiology and genetics of the condition[2]. Color vision is the ability to discriminate a light stimulus as a function of its wavelength. The sense of color is the end result of the absorption of several light stimuli from the three different types of cones and the following process and transmission of the sensory signal to the occipital cortex via the optic tract[3].

OBJECTIVES

1. To study prevalence of Colour vision defects between medical students.

2. To study "Gender difference" in the prevalence of Colour vision defects.

3. To study involvement of "Ethnicity" factor in the prevalence of Colour vision defects.

MATERIALS AND METHOD

This is a Cross-sectional study. Institutional ethical clearance from Ethical clearance committee and written informed consent from subjects was obtained after explaining the purpose and procedure of study. A total of 200 subjects were studied, which includes 100 Indian medical students from Belagavi Institute of Medical sciences Belagavi [BIMS] and 100 Malaysian medical students from USM-KLE International medical programme Belagavi, with 50 male and 50 female students in each group. All the five phases of students from MBBS first to fifth year that is including interns, with 20 students in each phase that is 10 girls and 10 boys from each phase were included in the study by random selection.

Sampling method and Sampling technique: 20 students from each phase have been selected randomly for the study.

The test for BIMS students was carried out in the OPD of Department of Ophthalmology at BIMS Hospital, Belagavi and for the students of USM-KLE International medical programme in the Lecture hall of USM-KLE International medical programme.

Students were examined by assessing the colour vision testing from a standard Ishihara's pseudoisochromatic chart and Edridge Green Lantern test.

By referring the article, sample size (200) was scientifically calculated[4] by using the formula as follows;

Inclusion criteria:

MBBS First to Fifth year that is including interns in the age group of 18 to 24 years and of both sexes from Belagavi Institute of Medical sciences (BIMS) and USM- KLE, International Medical Programme, medical colleges were selected by random selection.

Exclusion criteria:

Students with any eye abnormality, any present or past history of any eye diseases, history of trauma to eye, an insult like history of retinopathy, prematurity and genetic diseases associated with color vision defects were excluded.

PROCEDURE: After proper refraction testing, the following tests are carried out:

ISHIHARA'S PSEUDOISOCHROMATIC CHART:

The 38 plate Pseudoisochromatic chart consists of polychromatic plates containing printed figures made up of colored spots on a background of similarly shaped colored spots. The figures are intentionally made up of colors that are liable to look the same as the background, to an individual who is color deficient. The color vision testing plates are held at 75cm from the student and tilted at right angle to the line of vision. The test was performed binocularly in sufficient indirect daylight as recommended by Ishihara. All the plates of Ishihara chart was shown to all the participants and they were asked to read the impressions in the color chart, allowing 5 seconds for each plate. The types of color blindness were differentiated with the help of key provided with the chart. Two or more mistakes were taken as evidence

of defective color vision[4,5].

EDRIDGE- GREEN LANTERN TEST:

In this test, different colors are shown by a lantern and the subject is asked to name the colors. The lantern contains the following colors : pure red, red of different intensities, yellow, green, signal green, blue and purple. The subject sits in a dimly illuminated room 6 meters from the lantern. Subject names the color of the light, focused through the glass fixed on a rotating disc in the lantern. Each eye was tested separately and the other eye was covered with the help of subjects hand[5].

STATISTICAL ANLYSIS: Data obtained was statistically analyzed by using Chi-square test.

OBSERVATION AND RESULTS

Total sample size		
	BIMS Medical Students	USM-KLE, IMP Medical Students
Males	50	50
Females	50	50
Total	100	100
Grand total	200	

2. Overall Prevalence of Color vision defects in BIMS and USM-KLE medical students		
	BIMS Medical Students	USM-KLE, IMP Medical Students
Males	0	2
Females	0	0
Total	0	2
Chi-square	1	
P-value	>0.05	

Foot note: P value ‹ 0.05 is considered as significant

BIMS –Belagavi institute of medical sciences Belagavi

USM- KLE – Karnataka lingayat education international medical programme

By using Chi-square test our study showed that, in BIMS medical students none of them were color deficient whereas in USM-KLE medical students, 2% of students showed the color blindness for the Green color and females were not affected, indicating that the prevalence of color blindness is more in USM-KLE medical students than in BIMS students and this relation was statistically not significant.

DISCUSSION

Color blindness is most frequently inherited as sex-linked recessive disorder. Its incidence is much more common in males as compared to females, as reported by a number of authors.

In our study, the incidence of color blindness amongst BIMS and USM-KLE medical students in Belagavi was found and compared amongst each other. According to our study, the incidence of color blindness in male medical students of USM-KLE was found to be 2% and in females 0%, who were color deficient to only Green color and 0% incidence of color blindness was found in BIMS medical students. This indicates that the prevalence of color blindness was slightly more in USM-KLE students than compared to BIMS students and showed that males are more prone for color blindness than females. The statistical analysis by using chi-square test was non-significant.

In our study the causes for green color blindness were, one was due to congenital defect and second was due to the traumatic accidental event followed by right side hemiplegic attack.

Congenital color vision defect (CVD) has a prevalence of 8% for men and 0.4% for women in general population[6]. The acquired deficiencies are caused by ocular and intracranial pathologies[6], many drugs[7], diabetic retinopathy, hypertension, glaucoma, macular degeneration, yellowing of lens[8] due to ageing. Congenital color vision deficiencies are stationary and usually affect both eyes equally, whereas acquired deficiencies may be progressive and may affect just one eye depending on the underlying cause. Red- green perceptive disorders are x- linked recessive[9] and thus common in males but is transmitted via female.

Incidence of color vision defect which is genetic disorder, vary from race to race and are, therefore, different in the different geographical regions of the world inhabited by people of different ethnicity

Studies showed high incidence of color vision defect among males in country like Jordan8.7%[10], Europe8.0%[11],America8.0%[12],and Iran8.2%[13].However color vision defects was reported of lower incidence in Nepal 3.9%[14], India 2.3%[15], and China 3.0%[16]. Color vision defects in females were also noted in India (0.1% in Patiala city[17], 1.1% in Punjab[18]), 0.4% in Korea[19] and 0.4% in Tehran[13].

Color vision defects was observed more in Chhetri 14.38% followed by Brahmin 10.16% and Magar caste 9.89%[20] ,whereas in a study conducted in the same city in Nepal[14], reported more color vision defects in Darji 14.3% followed by Newar 9.1%. Since the color vision defect is genetically transmitted its distribution is likely to be variable in different ethnic groups. Studies showed more deutans than protans[21], which is explained by heredity of color vision defects[22].

The percentage distributions of color blindness were found different in different ethnic groups, highest in Arab male students 9.44% and female students 2.24%[23]. The higher prevalence rate of color blindness may be due to the hidden effect of consanguineous marriages. Congenital color blindness cannot be treated because this type of color defects are non-pathologic, incurable and remain constant throughout life[24], although several therapies have been proposed eg: Electrical eye stimulation, Iodine injections, large doses of vitamins, but there are no treatments or surgical procedures to improve the quality of an individual's chromatic vision[25].

A study showed the incidence of color blindness in males was found to be 2.48% and in females 0%, corroborating with our study[26]. The study showed an incidence of 2.209% and 1.84% in Indian and ethnic Libyan male populations respectively in a comparative study of the incidence of color blindness between sections of Libyan and Indian populations[27].

A study on school going children in Nepal, showed the prevalence of 2.1% had some form of color vision defects but of the male population, 3.9% had color vision defects while none of the female was found with deficiency, which correlates with our study[28]. But some researchers have found incidence of color blindness in females higher than the incidence reported in our study. An incidence of 0.33% in females of Jordan[29], 0.43% in females of Tehran[13] and 0.84% in Indian females[27] population have been reported.

Among the British male physicians, 8% were reported as color deficient[30]. Prevalence of color deficiency in European Caucasians, Chinese and Japanese men are 8%, 4% and 6.5% respectively[31]. The difficulties faced by color deficient medical students and doctors in their work were documented where they expressed their own experience[32] and a few studies reported the inconveniences of color deficient professionals in clinical and laboratory skills[33].

The acquired causes for color vision defects observed in other study were papillitis, optic atrophy followed by immature senile nuclear cataract, traumatic optic neuropathy and macular oedema[20]. Regarding various types of color vision defects, more deutrans were noted than protons[21], which corroborates with our study, which can be explained by the heredity of color vision defects[22].

The differences in the frequencies of color blindness in the two sexes can by explained on the basis of heredity of color vision deficiencies. These different studies indicate the prevalence of congenital color vision deficiency to be 2-6% in male population with very minimal of female being affected. Thus, there is less variation of color blindness incidence in males in various regions and in various communities of India than that of findings in other regions of world[26].

CONCLUSION

Study concludes that, overall prevalence of color vision defects was more in USM-KLE medical students than compared to BIMS medical students with increased prevalence being more in males than females, which could be due to the ethnic variations, different genetic predispositions, congenital color vision disorders and acquired causes for color vision defects. The study also concludes that there is gender variation and ethnicity factor is also involved in the prevalence of color vision defects.

Those with congenital color vision disorders should be properly counseled regarding difficulties in everyday work, their future profession and genetic inheritance to their children, which would prepare them for any future challenges and confusions, especially in relation to their education and career choice.

All people should be screened and advised about it so that they can take special care in daily practice as well

as in future life. Detection of color blindness at an early age can be extremely useful to avert or prevent certain occupational hazards including death in case of drivers of locomotives and automobiles.

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Do Blood Groups Determine Academic Performance in Medical Students? A Cross Sectional Study

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ABSTRACT

Introduction: Blood is a specialized connective tissue with complete and unchangeable identity with almost 400 blood grouping agglutinogens. Agglutinogens are antigenic determinants existing as membrane peripheral proteins on the outer surface of the erythrocytes. Agglutinins are plasma proteins of the Immunoglobin variety which exist in the plasma. Each type of the blood groups of ABO system has different characteristics. Importance of doing this study highlights the importance of blood group association with academic performance of the students.

Methodology: A Cross sectional study was conducted on 400 medical students between the ages 17 to 19 years. Internal assessment examinations were conducted every 3 months and an average of the scores obtained by each student during all the internal assessment examinations was calculated and recorded. A mean score of 35% and above and 65% and above were considered eligible for appearing in the University examinations and High scorers respectively. Blood samples were taken and the open slide method of ABO blood groups testing was followed. Blood groups, marks obtained by the students were tabulated in MS Excel sheet and were analysed using appropriate methods.

Observations: It was observed that 97.4% of blood group A were eligible for appearing in University examinations and 50.6% of the students belonging to blood group A were high scorers.

Conclusion: The present study concludes that maximum number of students who performed better in their academics belonged to blood group A.

Keywords: ABO blood groups, MBBS students, Eligibility, High Scorers.

INTRODUCTION

Blood is a specialized connective tissue with complete and unchangeable identity. Although almost 400 blood grouping antigens have been reported, the ABO and Rh

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are recognized as the major clinically significant blood group antigens. The ABO Blood grouping system derives its importance from the fact that both the agglutinogens A and B are strongly antigenic and the agglutinins anti A(Alpha) and anti B(Beta) occur naturally in the serum of persons lacking the corresponding antigen, as per the Landstiener's Law. These antibodies are capable of producing hemolysis in vivo. Rhesus blood group system was the fourth system to be discovered and yet it is second most important blood group from the point of view of blood transfusion[1]. With the ABO blood group, individuals are divided into four major blood groups

namely, A, B, AB and O according to the presence of agglutinogens and agglutinins. Agglutinogens are the antigenic determinants which are usually glycoproteins existing as membrane peripheral proteins on the outer surface of the Erythrocytes. The Agglutinins are plasma proteins of the Immunoglobin variety which exist in the plasma of the individual's blood. Group A blood has type A antigens, group B blood has type B antigens and group O blood has neither A nor B antigens. Also plasma from blood group A contains Anti-B antibodies which act against type B antigens, whereas plasma from type B blood contains Anti-A antibodies, which act against type A antigens. Type AB has neither type of antibody and type O blood has both A and B antibodies[2].One of the antigens on the surface of red blood cells, the Rhesus antigen (named because a related antigen was first discovered in Rhesus monkeys), is found on the red cells of approximately 85% of Caucasoid and 95% of Asiatic populations. This is the second most important blood group system due to its immunogenicity in Rh negative individuals in blood transfusion or pregnancy[3]. It has been scientifically proven that each person has characteristics different from other people, and that is due to blood type. Each type of the four blood groups has different characteristics. The holders of one blood type are characterized by kindness and frankness and have a sense of art in how to deal with others and other blood type are characterized by taking into account the feelings of others and not to injure them and prefer socializing and meeting new people. While one of the blood types are found to be hesitant in making decisions and it may be due to the frankness in dealing with others and thinking routinely somewhat[4]. Importance of doing this study highlights the importance of blood group association with academic performance of the students. There is very less literature supporting similar objective in India and especially Telangana.

METHODOLOGY

Type of study: A Cross sectional study was conducted to know the influence blood groups on MBBS students' academic performance at Kamineni Institute of Medical Sciences, Narketpally, Nalgonda, Telangana from January 2016 to July 2017.

A sample of 400 apparently healthy medical students (147 males and 253 females) of I MBBS between the ages 17 to 19 years were included in the study. Internal assessment examinations were conducted every 3 months in the pattern of University examinations. An average of the scores obtained by each student during all the internal assessment examinations was calculated and recorded. A mean score of 35% and above and 65% and above were considered eligible for appearing in the University examinations and High scorers respectively as per the rules of Dr.NTR University of Health Sciences, Vijayawada, Andhra Pradesh.

Blood groups were collected from past medical records during admission and reconfirmed during the blood grouping practical classes held during their course. Blood samples were taken by finger pricks by the students and the open slide method of ABO blood groups testing was followed. RBCs suspended in isotonic saline were treated with anti-A, anti-B and anti-D antisera (J. Mitra&Co, New Delhi) on glass slides and mixed with separate applicator sticks. The mixture was observed for agglutination with corresponding antisera and compared with the control for confirmation. Uncertainty was clarified by focusing the slide under microscope.

Blood groups, marks obtained by the students were tabulated in MS Excel sheet and were analysed using descriptive statistics and chi-square test to find out the the association between marks obtained by students and their blood groups.($p<0.05$).

OBSERVATIONS

Out of 400 students studied, 253(63.2%) were females and 147(36.8%) were males(Table 1) and the mean age of both male and female students was 17.5 years(Table 2). Table 3 shows that 139 students were O group, 136 students were B group, 77 students were A group and 48 students were AB group. It has been observed that maximum percentage of students (97.4%) who were eligible($\geq$35%) for appearing in university examinations belonged to Blood group A and this association is found to be statistically significant ($p<0.05$) (Table 4).Table 5 explains the association of blood groups and the high scorers ($\geq$65%), it was observed that 50.6% of the students belonging to blood group A as compared to 48.9% of group O, 43.4% of group B and 39.6% of group AB have scored high($\geq$65%). However this association is not found to be statistically significant ('p'=0.037).

Table 1: **Distribution of Age and Sex of the study population.**

Females Males			SEX		Total
AGE	17	Count	134	78	212
		% within AGE	63.2%	36.8%	100.0%
	18	Count	112	64	176
		% within AGE	63.6%	36.4%	100.0%
	19	Count	7	5	12
		% within AGE	58.3%	41.7%	100.0%
Total % within AGE		Count	253	147	400
			63.2%	36.8%	100.0%

Table 2: **Mean age and Standard deviation of the study population**.

Sex	Mean Age	Standard Deviation
Females	17.5 years	0.554
Males	17.5 years	0.566

Table 3: **Distribution of ABO Blood groups amongst study population**.

Females Males			SEX		Total
BLOOD GROUP	O	Count	89	50	139
		% within BLOOD GROUP	64.0%	36.0%	100.0%
	A	Count	51	26	77
		% within BLOOD GROUP	66.2%	33.8%	100.0%
	B	Count	84	52	136
		% within BLOOD GROUP	61.8%	38.2%	100.0%
	AB	Count	29	19	48
		% within BLOOD GROUP	60.4%	39.6%	100.0%
Total % within BLOOD GROUP		Count	253	147	400
			63.2%	36.8%	100.0%

Table 4: **Co relation of Blood groups with Eligibility (≥35%)**

Eligible (≥35%) Not Eligible (<35%)			ELIGIBILITY			Total
BLOOD GROUP	O	Count	129	10		139
		% within BLOOD GROUP	92.8%	7.2%		100.0%
	A	Count	75	2		77
		% within BLOOD GROUP	97.4%	2.6%		100.0%
	B	Count	126	10		136
		% within BLOOD GROUP	92.6%	7.4%		100.0%
	AB	Count	40	8		48
		% within BLOOD GROUP	83.3%	16.7%		100.0%
Total % within BLOOD GROUP		Count	370	30		400
			92.5%	7.5%		100.0%

Chi square = 8.505, d.f=3, 'p'=0.037*

*-statistically significant.

Table 5: **Co relation of Blood groups with High Scorers (≥65%)**

(≥65%) (<65%)			Aggregate Score		Total
BLOOD GROUP	O	Count	68	71	139
		% within BLOOD GROUP	48.9%	51.1%	100.0%
	A	Count	39	38	77
		% within BLOOD GROUP	50.6%	49.4%	100.0%
	B	Count	59	77	136
		% within BLOOD GROUP	43.4%	56.6%	100.0%
	AB	Count	19	29	48
		% within BLOOD GROUP	39.6%	60.4%	100.0%
Total % within BLOOD GROUP		Count	185	215	400
			46.3%	53.8%	100.0%

Chi square = 2.306, d.f=3, 'p'=0.511*

*-statistically non significant.
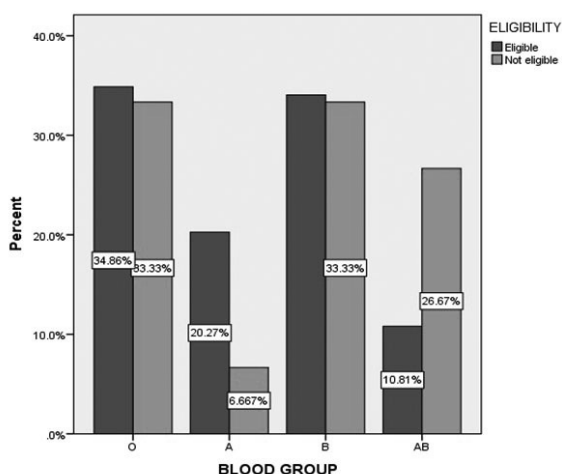
Figure 1: Bar diagram showing co relation of Blood groups with Eligibility

DISCUSSION

Antigens first identified on RBCs, are now known to be important as receptors and ligands for bacteria, parasites and immunological proteins[5,6]. There is an established association between blood groups and various disease conditions such as:cancers, peptic ulcer, coagulation disorders, bleeding disorders, clotting disorders, infections like Tuberculosis and renal diseases[7].In the last 20 years there has been increasing evidence that blood groups have a function and play a biological role[8]. This biological role often does not relate to the red cell, but to the presence of chemical moieties on other cells[11].Blood group antigens are not only important in relation to blood transfusion and organ transplantation, but also have been utilized in genetic research, anthropology and tracing ancestral relations of humans[9].

Rogan studied the relationship between platelets and Intelligence Quotient (IQ) and found that there is an increase in number of platelets on children from age 2 – 7 years and concluded that the increase in the number of platelets increases the IQ[10]. This shows the role of blood and blood group antigens played in human body.

Barakat did a study about blood groups and their relationship to certain emotional, personal traits on a sample of university students. The study concluded the presence of statistically significant differences between the students' degrees on mental depression, introversion, emotion, and pessimism for students whose blood type is B and the direction of students whose blood type is A on the traits of extroversion and optimism while the direction of students whose blood type is AB on the trait

of poise. Results also showed the absence of significant differences on the traits of anxiety whose blood group is O[13].

In present study, it was observed that maximum percentage of students who were eligible to appear in university examinations as well as high scorers belonged to blood group A followed by blood groups O & B. This is in contrast to findings of Bu Dinar [12] who attempted to answer the questions as to whether there were significant differences between children (6-14 years) in both verbal, practical and total IQ according to the different types of their blood and found that the sample AB excels at levels of intelligence and then followed by the sample O, while the sample B was the last one in IQ points. The contrasting result we obtained may be due to the fact that we have taken only the written examination of the students as a measure. Perhaps the AB group individuals are more adept at psychomotor and affective skills rather than merely cognitive skills. Mohumad Saleh Atoom observed that there is correspondence in the test's results and the cumulative average. And students whose blood group is AB got the highest cumulative average and the highest grade in the test, while students whose blood group is B got the lowest cumulative average and the lowest grade. These findings are consistent with what was published on the Japanese- Zodiac site[4].

CONCLUSION

The present study concludes that the maximum number of students who performed better in their academics belonged to blood group A. The need for distribution of blood group studies is multipurpose, as besides their importance in evolution, their relation to disease and environment is being increasingly sought in modern medicine.

LIMITATIONS

The limitations to the study are unequal count among the different blood groups, with a low number of participants with blood type AB and A. Also the academic performance has been assessed only by taking marks obtained in some written tests into account. Use of more questionnaires, tests to measure psychomotor and affective skills, and psycho analysis would be more wholistic. A near equal number of subjects in every blood group would enable us to obtain better results and it would be more feasible if we had a larger population to study.

Ethical Clearance: Permission was obtained from institutional ethics committee before the start of study and informed consent from all the participants of the study.

Conflict of Interest: Nil.

Source of Funding: Self.

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Gender Specific Association of hsCRP and Blood Glucose Levels in Diabetic Individuals

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ABSTRACT

The prevalence of diabetes is rapidly rising all over the globe at an alarming rate[1]. Complications of diabetes include microvascular and macrovascular complications[2,3]. High sensitivity C-reactive protein (hsCRP) is an acute phase reactant and a sensitive marker of inflammation. In addition to traditional cardiovascular risk factors, elevation in hsCRP can be used to predict increased cardiovascular risk in diabetic patients[4].

Keywords- *HsCRP, Fasting Blood Glucose, Diabetes Mellitus*

INTRODUCTION

Diabetes mellitus is a clinical syndrome characterized by hyperglycemia due to absolute or relative deficiency of insulin. Lack or deficiency of insulin affects the metabolism of carbohydrate, protein and fat. Long-standing metabolic derangement is associated with functional and structural changes in many organs, such as heart, kidneys, brain and eyes.[5] Hyperglycemia itself is a pro-inflammatory condition leading to an increase in inflammatory markers in blood. [6]

The newer 'high sensitivity C – reactive protein' (hs-CRP) is a measure of low grade chronic inflammation measured by a highly sensitive method. As the name suggests it is more sensitive than CRP. Hyperglycemia can potentially promote the production of CRP. A higher level of hs-CRP in diabetic patients indicate that micro/macrovascular changes have occurred in the patient. In addition to inflammation, increased levels of CRP in male and female subjects could indicate risk of cardiovascular disease in patients with type- 2 diabetes mellitus .Studies have suggested that the biomarker of inflammation can suggest increased risk of CVD in men than in female patients. [7]

HsCRP has been estimated in diabetic subjects in several studies.[8,9] Elevated levels of hs-CRP in patients with type 2 DM were observed in some studies.[7,8]But in these studies the diabetic subjects were either obese, having a high lipid profile, or hypertensive. Obesity and hypertension leads to an increase in hs-CRP levels.[8] Therefore in this study we chose non-obese, normotensive subjects to make sure that there is no other triggering factor to cause an increase in hs-CRP other than diabetes mellitus.

Thus the current study was planned to estimate hs-CRP and fasting blood glucose levels in type 2 diabetic and non- diabetic male and female subjects. It was also planned to explore if there is any gender difference in levels of hsCRP in diabetic and non-diabetic subjects.

MATERIAL AND METHOD

Present study was conducted from May 2013 to May 2014 in a local Medical College and Hospital. As per revised Helsinki Declaration, institutional ethical committee approval was obtained for the study. Protocol was explained to the participants and written consent was obtained.

Study was conducted on 120 volunteers (60 males and 60 females) in the age group of 50-65 years. Subjects with history of isolated type 2 diabetes

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mellitus for more than 5 years and under treatment were included in study group. Subjects with habit of smoking and alcohol, pregnant and lactating women, overweight and obese subjects were excluded .Also subjects having recent history of fever, any acute or chronic infection, allergic reaction, insect bite, those suffering from any autoimmune disease like rheumatoid arthritis or suffering from any hepatic, renal or cardiovascular diseases were excluded from this study.

Blood sample of 3ml was drawn in the morning following 8 hours of fasting under all aseptic precautions. To avoid the effect of any diurnal variations on hs-CRP, the time of collection of blood was constant between 9am – 11am.

Subjects were divided into two groups based on fasting blood glucose levels

Study group: It consisted of 60 subjects (30 males and 30 females).

Control group: It consisted of 60 healthy individuals (30 males and 30 females), with no history of diabetes mellitus and normal BMI.

Following parameters were assessed in the subjects of both the groups :

Fasting blood glucose level by GOD-POD (glucose oxidase peroxidase method),using Fully automated EM 360 Biochemistry analyzer/colorimeter.[10]

High sensitivity C-reactive protein by Chemiluminescence immunoassay system (CLIA).[11]

RESULTS

Statistically significant difference was seen in the FBG and hs-CRP levels in male and female diabetic subjects and male diabetic subjects had higher hsCRP levels than the female diabetic subjects.

There was no statistically significant difference in the height, weight, waist circumference(WC) and BMI between the male and female subjects in both study and control group. All the parameters were within normal limits.

Table No.1: hsCRP and fasting blood glucose levels in male and female subjects of control group.

Parameters	Control group		P value
	Male(n=30)	**Female(n=30)**	
hsCRP(microgm/ml) (Mean±SD)	0.34±0.37	0.18±0.28	>0.05*
FBG(mg/dl) (Mean±SD)	89.10±10.31	85.23±9.24	>0.05*

*P >0.05- not significant

†P< 0.05 – Statistically significant

As shown in table no.1 the FBG and hs-CRP levels in non-diabetic male and female subjects showed no statistically significant difference .

Table No.2: hsCRP and fasting blood glucose levels in male and female subjects of study group.

Parameters	Study group		P value
	Male(n=30)	**Female(n=30)**	
hsCRP(microgm/ml) (Mean±SD)	1.96±1.00	1.41±1.04	**<0.05†**
FBG(mg/dl) (Mean±SD)	162.93±67.53	139.33±63.84	**<0.05†**

†P< 0.05 – Statistically significant

There is statistically significant difference in the FBG and hs-CRP levels in diabetic male and female subjects (table no.2).

STATISTICAL ANALYSIS[12]

Data analysis was analyzed by unpaired t- test by using SPSS version 19.0. Data was expressed as Mean± SD. P < 0.05 means that value of the corresponding test was statistically significant.

DISCUSSION

There have been studies done to explore gender difference in hsCRP levels.[13,14,15] These studies have shown that the hsCRP levels are higher in female subjects. They have observed that this rise in hsCRP was due to high BMI in females as compared to males. This is in contrary to the result of the current study. The hsCRP levels were significantly higher in male diabetic subjects than in the female diabetic subjects of our study. This may be due to the increased blood sugar levels found in the male subjects compared to the female subjects.

Similar results have been found in a study done by Seishi Yamada et al [16]. Their findings were correlated with increased BMI in male subjects as compared to female subjects. It has been observed that increased levels of hs-CRP are associated with increased risk for cardiovascular diseases.

Recent research evidence supports a link between hyperglycemia and inflammation. CRP is known to be higher in people with impaired glucose tolerance and frank diabetes. The results in a study by Ryuichi et al suggested that hsCRP levels increased continuously across the fasting blood glucose spectrum.[17]

Studies have related hyperglycemia to inflammation by demonstrating simultaneous inflammation, endothelial dysfunction, and insulin resistance at the physiologic level.[18] One of the several mechanisms proposed is oxidative stress on the endothelium, which promotes inflammation and is enhanced by hyperglycemia.[19]Such evidence is consistent with the findings in the current study, which further documents the association between hyperglycemia and inflammation in adults with diabetes.

In a nut shell rise in hs-CRP levels in male than female diabetic subjects could be due to, low-grade chronic inflammation leading to production of inflammatory cytokines, formation of advanced glycation end products, inflammatory cytokines released by adipocytes or decreasing β cell mass through IL-1β induced apoptosis. [18,19]

The gender specific association of rise in hsCRP observed in this study highlighted that hsCRP was more in male subjects than in female subjects which may predisposes them to inflammatory and cardiovascular diseases at an earlier age.

Longitudinal study is needed to determine whether gender differences in hsCRP levels contribute to differences in cardiovascular outcomes, and whether thresholds for cardiovascular risk assessment should be adjusted for gender groups.

Limitations

The sample size was very small.

HbA1C was not estimated to assess the glycemic status of the subjects.

Other pro-inflammatory cytokines(interleukin-6,TNF-alpha) were not estimated.

CONCLUSION

The present study was aimed to explore gender specific association of hs-CRP and blood sugar levels in type 2 diabetic patients. The results of this study showed that there was statistically significant difference seen in hs-CRP levels between male and female diabetic subjects. Fasting blood glucose and hs-CRP was seen to be much higher in male diabetic subjects than in female diabetic subjects. This study proves that there is gender difference in hsCRP levels in male and female diabetic subjects.

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Myopia among Medical Students – A Cross Sectional Study at Belagavi Institute of Medical Sciences, Belagavi

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ABSTRACT

Introduction: Of all the human senses, the sense of vision is used the most and so, is affected the most. Refractive errors are becoming a more problem of concern, especially Myopia has become very common problem.

Objectives: To study the prevalence and "Gender difference" of Myopia among medical students.

Materials and Method: Includes 100 medical students of Belagavi Institute of Medical Sciences (BIMS) Belagavi, of all the five phases, who were tested for presence of Myopia with the help of Snellen's chart, Jaegers chart and confirmation by the pinhole test.

Result: Overall prevalence of Myopia was 46% in BIMS medical students, with male students 20% and female students 26%, also myopia with astigmatism in BIMS students was 7% with 2% males and 5% females, indicating more prevalence in females than males.

Statistical Analysis: By using Chi-square test

Conclusion: The prevalence of Myopia was more in BIMS medical students, females being more affected than males, which could be due to ethnic variations, genetic predisposition, higher levels of education with more near work activities and longer study periods.

Keywords: Myopia, Medical students.

INTRODUCTION

Myopia is a refractive error in which eye fails to see distant objects properly[1]. It has become an ocular disorder of major public health and socioeconomic significance throughout the world[2]. Several studies describe an increasing prevalence of myopia in the recent years and racial differences in myopia rates are well documented.

Refractive errors remain one of the primary causes of visual impairment in children worldwide[3]. As per WHO report, uncorrected refractive error remains the second commonest cause of global visual impairment next to the cataract[4]. The overall incidence of Refractive errors has reported between 21 % and 25 % of patients attending eye OPD in India. Refractive errors are responsible for significant proportion of blindness and moderate visual impairment in Indian population[5]. Refractive error is a remedial cause of visual impairment with correction of significant Refractive errors being a priority of "VISION 2020: THE RIGHT TO SIGHT", the joint global initiative of World Health Organization and the International Ageing for prevention of Blindness[6].

One group which requires attention is the student population, because they are subjected extensively to work where maximal vision is used. Thus, knowledge of prevalence of refractive errors in them and their correlation with gender, type of diet, religion [ethnicity] and education stream would help to plan the effective

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refraction services.

Blindness and visual impairment from myopia will lead to major public health problems for many countries in Asia[7]. Both nature and nurture have been blamed in the prevalence of myopia[8]. In India, the prevalence of myopia is 7-11% in 15 year old and 35% in adults[9]. Recent reports suggest an East Asian trend of high prevalence of myopia among students, reaching 'epidemic' proportions[10]. MBBS students in India are also reported to have a high prevalence of myopia[11].

High myopia is associated with retinal tear, retinal detachment, macular degeneration, cataract and glaucoma. The economic costs of correction for myopia with spectacles, contact lens or LASIK in optometry and ophthalmology centers leads to heavy burden of amount to the peoples[12].

OBJECTIVES

1. To study prevalence of Myopia in medical students

2. To study "Gender difference" in the prevalence of Myopia.

MATERIALS AND METHOD

This is a cross-sectional study. Ethical clearance from Institutional ethical clearance committee and written informed consent from subjects was obtained. A total of 100 subjects were studied, which includes 100 medical students from Belagavi Institute of Medical sciences Belagavi [BIMS], with 50 male and 50 female medical students in each group. All the five phases of students from MBBS first to fifth year including interns, with 20 students, 10 girls and 10 boys from each phase were included in the study by random selection from BIMS medical college, at Belagavi. After explaining the purpose and procedure of the study the test was carried out in the OPD of Ophthalmology at Belagavi institute of medical sciences, BIMS Hospital Belagavi.

Students were examined by assessing the visual acuity from a standard Snellen's chart for far vision and Jaegers chart for near vision. Those having a visual acuity less than 6/6 in one or both eyes were tested for the presence or otherwise of myopia by Pinhole testing [indicating refractive error].

The sample size (100) was scientifically calculated[13].

Inclusion criteria:

MBBS First to Fifth year including intern students of Belagavi Institute of Medical sciences (BIMS), were selected by random selection.

Exclusion criteria:

Students with any eye abnormality, present or past history of any eye diseases, Diabetes mellitus, history of trauma to eye , history of retinopathy of prematurity, genetic and connective tissue diseases associated with refractive errors mainly myopia.

PROCEDURE:

SNELLEN'S CHART: The subject is seated at a distance of 6 meters (20 feet) from a well-lighted chart and is asked to read the letters down the chart as far as possible. Each eye is tested separately with glasses as well as without glasses. A normal person should be able to read 7th line that is, visual acuity of 6/6[14].

JAEGER'S CHART: The subject is asked to read Jaegers chart held at the ordinary distance of 15 inches. Chart is made up of reading material of various sizes with the smallest size at the bottom. A modification of the original Jaegers system is used and visual acuity is expressed in terms of printer's point system-N5 is smallest type and largest type is N36[14].

PINHOLE TEST: It helps in confirming whether the optical correction in trial frame is correct or not. An improvement in visual acuity while looking through an pin-hole indicates optical correction in trial frame is incorrect[15].

STATISTICAL ANLYSIS: Data using Chi-square test.

OBSERVATION AND RESULTS:

Prevalence of Myopia and Myopia with Astigmatism in BIMS medical students at Belagavi			
	Sample size	Myopia	Myopia with Astigmatism
Males	50	20	2
Females	50	26	5
Total	100	46	7
Chi-square	-	0.78	1.29
P-value	-	>0.05	>0.05

By using Chi-square test study shows, prevalence of myopia was more in female students than males and this relation was statistically non-significant.

DISCUSSION

Refractive errors are more prevalent among high educational group. They are one of the most common causes of visual impairment around the World and second leading cause of treatable blindness. A study reported the high prevalence of Refractive errors amongst medical students and unawareness about it[13].

Educational status has been shown to be closely related to near work and association between near work activities and myopia has been reported previously, which has also been used in support of the "use-abuse theory" and myopia[16].

Among the refractive errors Myopia is the most common type. Prevalence of myopia in BIMS medical students was 46% with 20% males and 26% female students, indicating increased prevalence in female students than male students, which could be due to the ethnic variations, different genetic predispositions, higher levels of education which is associated with near work activities and long study periods. Also myopia with astigmatism was 7%, with 2% males and 5% females, indicating more prevalence in females than males, which could be due to the ethnic variations, different genetic predispositions and hereditary factors.

A study showed that there is increasing number of students having a mild to moderate degree of myopia[13]. Reports on prevalence of myopia in medical students in Asian countries showed higher rates of 82% and 89.8% in Singapore[17], 92.8% in Taiwan[4] and 87.6% in Malaysia[18].

Similar studies on medical students in Norway, Denmark and Turkey yielded relatively lower prevalence rates of 50.3%, 50% and 32.9% respectively[19], which corroborates with our study.

Higher prevalence rates of myopia have been reported among medical students across several studies in many countries[20]. A Greek study reported higher prevalence rate of myopia in females, which showed no overall statistical significance[21], which correlates with our study. The role of gender on refractive errors is inconclusive[22], which could be assumed that since growth spurt appears much earlier in girls, the eye tends to attain longer axial length and consequently higher axial myopia. In Post-pubertal periods, boys catch up and ocular measurements in both sexes then even out.

Study conducted in Indian medical students in 1979 has shown myopia prevalence among medicos as 24%[23], showing lesser prevalence rates than our study. Study showed prevalence rate of myopia in Indian medical students have increased over past two decades. In contrast, a study reported as no difference in myopia prevalence between males and females[24]. But another study reported myopia more common in males while assessing myopia prevalence in general population[25], which could be because of interference of other factors which affect the prevalence of myopia like maladjusted education study levels.

High prevalence rates of myopia have been reported among medical studies because of the high level of educational attainment[26], long and intensive study regimen[27] and prolonged near work[4].

High prevalence of myopia was found among AIMC students 57.6% and first and second year students had greater percentage indicating that it is increasing in younger age group and showed that excessive intelligence and school work which newer students have to undertake leads to early development of myopia[28]. Several factors including genetic and environmental influences like near work, night lighting and uv exposure are also play role in determination of Refractive status of eye but the true underlying mechanism remain unclear[29].

Myopia is the predominant Refractive error detected among medical students[30]. Myopia is the most common Refractive error found in students followed by astigmatism and hyperopia. Same pattern of distribution of Refractive errors were observed in general adult Indian population that is, 34.6% myopia, 37.6% astigmatism and 18.4% hyperopia[31], corroborating with our study.

Medical students, have to indulge in a lot of curricular near work, predisposing them to development of myopia. Furthermore, excessive near work indulged by students is a known risk factor for myopia[32]. Therefore, it is possible that academic competition led to selection of more myopes for medical education. As per study published in 1969, recently acculturated Eskimos showed a very large difference in prevalence between older subjects (1.5%), who had little or no

schooling vis-à-vis the younger subjects (51%), who had compulsory schooling[33]. The high prevalence of myopia in these younger Eskimos was thought to be due to the then recently introduced excessive near work of reading[33]. Their myopic progression was related to the high demands for near work and could be slowed in vacations while near work decreased[34]. It has also been suggested that increasing westernization, particularly the availability of store-bought food that was high in sugars and carbohydrate, may have been associated with the rapid increase of myopia noted in the then recently acculturated Eskimos[33].

CONCLUSION

Study concludes that, prevalence of myopia was more in BIMS medical students with, female students having increased prevalence than that of males, which could be due to the ethnic variations, genetic predispositions and higher level of education which is associated with near work activities and longer study periods in medical field. Also Myopia with Astigmatism was found in BIMS medical students, which was more prevalent in females than males, which could be due to the ethnic variations, different genetic predispositions and hereditary factors.

This study has thrown some light on distribution of refractive errors on student population and has shown that education stream acts as an important factor in determining the type of refractive errors.

In Asian studies we can see that over two decades the prevalence of myopia has increased in Indian medical students and it is coming close to results obtained from other Asian countries. Highest prevalence of myopia in medical students than compared to engineering and arts students supports the role of environmental changes like stress and time spent in full time education in myopisation. It has also emphasized and justified the saying "Deteriorating vision-an occupational hazard for medical students". This study produces a small insight of ongoing problem of refractive errors in students. Much work is still needed to assess on a larger scale to enable alterations of the environmental factors responsible for causing refractive errors for the betterment of generations[24]. It also urge for further investigative studies along with specific lines that indicate the exact causes of increase in myopia and the actions to mitigate factors causing refractive errors.

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Comparison of Visual and Auditory Reaction Time of Hand and Foot in Healthy Adults

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ABSTRACT

In the present study Visual reaction time(VRT) and Auditory reaction time(ART) was recorded in the hand and foot in 100 adults with the help of Response Analyzer and compared. VRT was more in the right foot than in the right hand and more in the left foot than in the left hand. Similarly ART was more in the right foot than in the right hand and more in the left foot than in the left hand.

Keywords : Visual reaction time, Auditory reaction time, Response Analyzer.

INTRODUCTION

Reaction time is the interval time between the presentation of a stimulus and the initiation of the muscular response to that stimulus. Reaction time is the time taken by an individual to react to a stimulus. Many factors have been shown to affect reaction time like age, gender, exercise, alcohol ,distractors, type of stimulus diseases like diabetes, peripheral neuropathies etc. In cognitive psychology, reaction time (RT) is used to measure the amount of time that it takes an individual to process information . It is the duration of the interval between presentation of a stimulus and the participant's response to the stimulus. Some of the authors have studied the difference in reaction time of upper and lower extremities. It also has been a topic of discussion to use hand driven medical devices or paddle or foot driven .

MATERIALS & METHOD

In the present study VRT and ART was recorded in upper and lower extremities in 100 healthy adults with normal visual and auditory acuity. VRT and ART was recorded with the help of a simple device **Response Analyzer**. Stimulus for VRT was a yellow soothing light with fixed intensity and for ART was a buzzer with fixed intensity. Subject was asked to press the switch with thumb in case of upper extremity and with the great toe in case of lower extremity as soon as stimulus was presented. Each time 3 readings were taken and lowest reaction time was taken for as final. Time of recording was between 11 am to 1 pm and recording was done in a silent room. The data was statistically analyzed by T test and compare

RESULTS/OBSERVATIONS/FINDINGS

1. Visual reaction time of right and left hand is significantly shorter than that of right and left foot respectively as shown in observation Table 1

2. Auditory reaction time of right and left hand is significantly shorter than that of right and left foot respectively as shown in observation Table 2

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Table No 1: Comparison of VRT between Hand and Foot

	VRT (n=100) Msec		VRT (n=100) Msec	
	Right Hand Mean _+ SD	**Right Foot Mean _+ SD**	**Left Hand Mean _+ SD**	**Left Foot Mean _+ SD**
	190.87 +_ 8.77	213.49+_15.49	200.43+_5.12	223.86+_4.62
SE	1.78		0.69	
Zvalue	12.70		33.96	
Pvalue	P<0.001		P<0.001	
Result	Very Highly Significant		Very Highly Significant	

Table No 2: Comparison of ART between Hand and Foot

	ART (n=100) Msec		ART (n=100) Msec	
	Right Hand Mean _+ SD	**Right Foot Mean _+ SD**	**Left Hand Mean _+ SD**	**Left Foot Mean _+ SD**
	175.22 +_ 15.41	196.46+_20.77	188.13+_13.59	207.03+_4.01
SE	2.59		1.42	
Zvalue	8.20		13.31	
Pvalue	P<0.01		P<0.001	
Result	Highly significant		Very Highly Significant	

DISCUSSION

VRT of right hand is less than that of right foot and VRT of left hand is less than that of left foot as shown in Table 1. The difference is statistically very highly significant.

Similarly ART of right hand is less than that of right foot and ART of left hand is less than that of left foot as shown in Table 2. The difference is statistically very highly significant. Thus the results in Table no 1 & 2 show that the reaction time of upper extremities is significantly less than that of lower extremities.

Similar results were obtained by other researchers like Madan Mohan et al.[3,] Neena Misra et al.[4], Simonen et , al.[8]

Significant anatomical and functional asymmetries have been reported in upper and lower extremities. Reaction time is shorter in upper limbs than that in lower limbs for anatomical and physiological reasons

The impulses to hand travel a shorter route as compared to foot and faster motor conduction velocity may be responsible for faster hand reaction time than foot reaction time[4,6,7]

Shorter nerve-conduction time for the brain-hand combination than for the brain-foot combination because the neural pathway from the brain to the hand is shorter.

Marcel Pfister,1,2 Jaw-Chyng L. Lue, et al. recorded shorter reaction time for hands than feet to improve RTs in the surgical field, hand-controlled devices appear to be desirable. [5]

Dr. Grrishma, B., Dr. Gaur et al.[2]have showed that auditory recognition reaction time was significantly more for foot when compared with hand. This could be because of difference in nerve conduction velocity and movement time of the hand when compared with that of foot. Nerve conduction velocity is more in upper limb than lower limb. This could be because of abrupt distal axonal tapering in lower limbs, shorter intermodal

distance in lower limbs, progressive reduction in axonal diameter in lower limbs and lower temperature in feet when compared to hands (Dhavalikar et al., 2009; Pal and Pal, 2010)[1]

It was found that execution time for foot movements is generally about twice as long as that for the equivalent arm movement (Hoffmann,1991).

Shorter impulse travel route, faster conduction velocity and shorter execution time explains the faster reaction time in upper extremities than that in lower extremities in the present study

CONCLUSION

Visual reaction time and Auditory reaction time of hands is significantly shorter than feet. This indicates ability to perform rapid, controlled movements , psychomotor skills and a better neuromuscular control exhibited by upper extremities than lower extremities. Hence use of hand driven devices is desirable over paddle or foot driven, in medical field. However further study is required.

Conflict of Interest : Nil

Source of Funding: Self

Ethical Clearance : Yes

Informed Consent: Was taken

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Diagnostic Value of Vibration Perception Threshold in Diabetic Peripheral Neuropathy

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ABSTRACT

Objective: To validate the discriminative power of Vibration Perception Threshold (VPT) considering Nerve Conduction Studies (NCS) as gold standard in type 2 diabetes mellitus in the diagnosis of diabetic peripheral neuropathy.

Materials and Method: Thirty patients with Type 2 diabetes mellitus and thirty subjects who are age, sex and BMI matched normal controls were tested with Vibration Perception Threshold and Nerve Conduction Studies; mean ± SD of the characteristics were calculated.

Sensitivity, specificity, positive and negative predictive values for the Vibration Perception Threshold was calculated, considering Nerve Conduction Studies as gold standard.

Results: The positive and negative predictive values were calculated to be 84% and 74.29% respectively. The sensitivity and specificity of VPT was found to be70 % and 86.6% respectively.

Conclusion: Vibration Perception threshold has shown positive correlation with NCS in the evaluation of peripheral neuropathy in diabetes. It may be a better screening tool due to simple procedure and cheaper in cost.

Keywords: *Nerve conduction studies, Vibration perception threshold, sensitivity, specificity.*

INTRODUCTION

Diabetic peripheral neuropathy (DPN) is one of the most common complications which lead to severe morbidity or even amputation of the foot if not treated properly. Thus early identification of the disease by proper screening is required to improve foot care and preventing morbidity. In diabetics, the annual population-based incidence of foot ulcer ranges from 1.0 to 4.1 per cent and the prevalence ranges from 4 to 10 per cent, the lifetime incidence may be as high as 25 per cent[1].

Foot problems are one of the most common complications in people with diabetes because of increased risk of peripheral neuropathy, peripheral vascular disease, abnormal pressure on the foot, and impaired resistance to infection.

These factors frequently combine and result in ulceration and infection, progression to gangrene, and subsequent lower limb amputation. Clinical trial evidence for the efficacy of screening strategies have demonstrated reduced incidence of amputation and ulceration and thus screening for neuropathy is recommended in clinical practice guidelines[2].

The screening methods are quite variable and ill defined. Many advances have taken place in the detection of diabetic peripheral neuropathy (DPN) related to electrophysiological techniques and quantitative sensory testing.

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Nerve conduction studies (NCS) are the most objective noninvasive measures of nerve function. Studies suggest that in type 2 diabetes mellitus, even at the time of diagnosis 45-60% were diagnosed with diabetic neuropathy. NCS are strongly correlated with underlying structural changes and are the least subjective and most reliable single criterion standard.

Pain insensitivity is caused by degeneration of intraepidermal nociceptors, i.e. nerve endings of C-fibres and A-delta fibres. Concomitantly, A-β-fibres, conducting vibration sensation impulses, undergo axonal degeneration with subsequent lack of function [3,4]. Hence deficient vibration sensation is another symptom of painless diabetic neuropathy. Measuring vibration perception at the feet is an established test to diagnose diabetic neuropathy [5,6].

Studies have shown that VPT was simple, reliable, and reproducible and this has led biothesiometer [7,8] comparable to NCS in diagnosing peripheral neuropathy.

This study aims to compare the diagnostic value of vibration perception threshold (VPT) considering nerve conduction studies (NCS) as gold standard in diagnosing diabetic peripheral neuropathy.

MATERIALS AND METHOD

30 patients in the age group of 40 to 60 years with established type 2 diabetes (WHO criteria) [9] with positive DNS (Diabetic Neuropathy Symptom) score , Nerve conduction studies, positive for neuropathy[10] with no history of smoking from M.S. Ramaiah hospitals were recruited as cases.

30 age, height and sex matched healthy subjects with Fasting blood sugar < 100mg/dl, DNS score-0; Normal NCS were recruited as controls by history, questionnaire and clinical examination from general population.

Those with symptoms related to other neuropathies like chronic renal failure, previous spinal injury, history of cervical or lumbar discopathies, history of alcohol abuse, history of vitamin B12 or folate deficiency were excluded.

Informed consent was taken from all subjects. Ethical clearance was obtained from the institutional ethical committee for human research to conduct the study.

Vibration Perception Threshold:

VPT was tested using Sensitometer, Dhansai laboratory, Mumbai. After explaining the procedure properly to the subject, the probe was applied to greater toe, 1st metatarsal, 3rd metatarsal, 5th metatarsal, middle arch, heel, dorsal pedis, and posterior tibial arch of both the feet with the patient in supine position in a quiet room. The vibration was increased gradually from minimum voltage and transition from no vibration to the onset of perceiving vibration was taken as the vibration perception threshold score. The Yes/ No method was used. The VPT was tested on eight areas on foot. An average of all the values was taken as VPT of the subject. The VPT was measured in volts. A voltage more than 25 V was taken as presence of neuropathy [11].

NCS was recorded with the instrument, EB Neuro Galileo Nemus2, Italy.

Diabetic Neuropathy Symptom score:

All subjects were questioned regarding the presence of symptoms, either positive or negative suggesting the presence of neuropathy. The questionnaire was the Diabetic Neuropathy Symptom (DNS) Score [12] adopted from the Neuropathy Symptom Score (NSS) of Dyck [13].

The questions should be answered 'yes' (positive: 1 point) if a symptom occurred more times a week during the last 2 weeks or 'no' (negative: No point) if it did not.

Symptoms of unsteadiness in walking?

Do you have a burning, aching pain or tenderness of your legs or feet?

Do you have pricking sensations at your legs and feet?

Do you have places of numbness on your legs or feet?

Maximum score: 4 points; 0 points- peripheral neuropathy absent; 1-4 points - peripheral neuropathy present.

The Statistical software namely SPSS 15.0 was used for the analysis of the data.

Correlations were assessed with Spearman's correlation. By constructing Receiver operating characteristic curve, sensitivity, specificity, positive and

negative predictive values and accuracy were calculated, considering NCS as the gold standard definition of neuropathy. $p < 0.05$ was considered as statistically significant.

FINDINGS

Our study consisted of 30 subjects with diabetic peripheral neuropathy comprising the case group and 30 age, sex and height matched normal healthy adults comprising the control group. The mean age of the cases was 53.43 ± 5.59 years and that for the controls was 53.07 ± 5.54 years .Samples are age matched with p = 0.546. Both groups consist of 16 male and 14 female subjects. Basic anthropometric details were given in table 1.

There was no statistically significant difference between cases and controls in the anthropometric parameters. The two groups were comparable.

Table1 - General parameters of subjects in cases (type 2 diabetics) & controls group; expressed in mean ± SD

N=60	Cases N=30	Controls N=30	p value
Age	53.43±5.59	53.07±5.54	0.546
Sex(m/f)	16/14	16/14	1.000
Height (cm)	164.67±8.76	166.90±5.83	0.250
Weight(kg)	68.00±7.28	67.48±7.94	0.672
BMI(kg/m²)	25.27±2.92	24.39±2.78	0.153

BMI - Body Mass Index; statistical analysis was done by students unpaired 't' test. p -value <0.05 was considered significant.

The sensitivity and specificity of VPT was found to be 70 % and 86.6% respectively and ROC curve shown in graph 1. The positive and negative predictive values were calculated to be 84% and 74.29% respectively shown in table 2, table 3.

Table 2: Comparison of VPT with NCS: An Observation

Comparison with NCS	True Positive	False Positive	False Negative	True Negative	Total
VPT	21	4	9	26	60

Table 3: Validation of VPT with NCS: An Evaluation

Comparison with NCS	Sensitivity	Specificity	PPV	NPV
VPT	70.00	86.67	84.00	74.29

PPV-positive predictive value, NPV- negative predictive value.
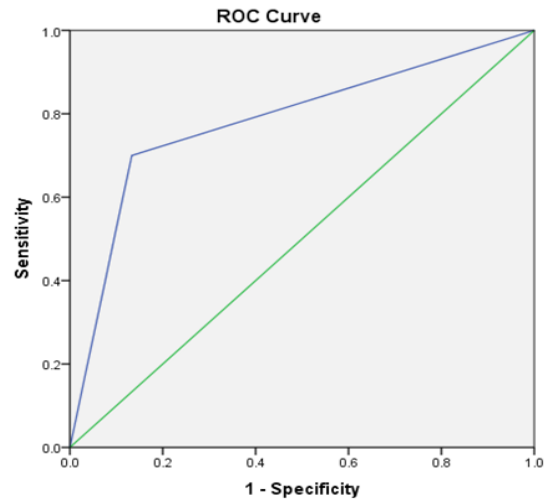
Graph 1: ROC curve showing sensitivity and specificity of VPT

DISCUSSION

Diabetic peripheral neuropathy is a complex disease of progressive nerve fiber loss. Initial screening and diagnosis in clinical practice usually depend on assessment of subjective complaints. American Diabetes Association and clinical practice guidelines recommend annual screening for neuropathy to identify asymptomatic individuals who are likely to develop complications. Evidence indicates early detection of DPN results in fewer foot ulcers and amputations[14].

Though NCS has lot of merits when compared with other screening tools of diabetic peripheral neuropathy, the main drawbacks are for requirement of sophisticated instrument and exclusive neurology lab. Moreover the recoding is cumbersome and needs to be done only by trained personnel. The procedure is relatively costly.

American Diabetes Association and clinical practice guidelines recommend annual screening for neuropathy to identify asymptomatic individuals who are likely to develop complications. The typical DPN is a chronic, symmetrical, length-dependent sensory motor polyneuropathy and is thought to be the most common

variety.

Our study has shown sensitivity of VPT to be 70% and specificity as 86.6%. There were clinical studies which prove the efficiency of VPT by showing sensitivity and specificity of 80 and 98 per cent respectively [15]. This was still confirmed by large epidemiological prospective studies showing that a VPT more than 25 V had a sensitivity of 83 per cent, a specificity of 63 percent[16].

There were studies showing sensitivities between 58 and 84% and specificities between 61 and 86% for VPT [17,18]measured by a variety of test devices and test methods. These wide variations may be because of the use of tuning fork of varying frequencies and the sites of examination also varied between studies.

The positive and negative predictive value of our studies was 70 % and 84% respectively.

According to studies done by Mythili et al; the positive and negative predictive values were 90% and 16% respectively [15]. The difference may be due to later study was conducted with a larger population size.

Studies conducted by Davies, et al have demonstrated that vibratory thresholds can detect subclinical neuropathy in diabetes [19].

Boulton, et al have also proved in their studies that vibration perception thresholds provide a strong marker of "risk" for future ulceration across a wide range of ages and durations of diabetes [20].

Studies have verified that VPT test results are reproducible. When the test was repeated, same day testing in a randomly selected subset of subjects test-retest coefficient of reliability is good (0.85)[21].

In our study, VPT showed positive correlation, with rho 0.575 which is highly significant (p=0.000).VPT testing is not specific to large fiber or peripheral nerve dysfunction and the results are influenced by subject attentiveness, motivation, and fatigue [7,8].

Reproducibility may vary in non diabetic and diabetic populations, and the results also vary depending on the device used. The advantages of VPT are simple, quick to perform, painless, and generally well tolerated. VPT results are not significantly affected by the presence of foot callus or by limb temperature.

These advantages and the availability of standardized testing algorithms make VPT an attractive option for diabetic peripheral neuropathy assessment in research settings.

CONCLUSION

In the present study the screening technique for diabetic neuropathy, VPT was validated considering NCS as gold standard. The diagnostic value is much nearer to gold standard. Hence VPT can be used in the place of NCS, where the latter is not feasible because of costlier cumbersome technique.

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Comparative Study of the P100 Values with Varying Duration of Type 2 Diabetes Mellitus

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ABSTRACT

Background: The Pattern Reversal Visual Evoked Potentials (PRVEPs) are used in evaluating the normal functioning of the visual pathway. Retinopathy being one of the complications of diabetes effecting the visual pathway, the aim of the study is to compare the P100 values with varying duration of Type 2 Diabetes Mellitus (Type 2 DM).

Materials and Method: A cross sectional study was done after obtaining written consent from all subjects and obtaining approval from the Institutional Ethics Committee. PRVEPs were performed using Viking Select neuro-diagnostic system .[Viasys Healthcare, USA].

Three study groups were selected basing on the duration of type 2 DM.

Group 1 -30subjects with duration of <5 years.

Group 2 -30subjects with duration of 5-10 years

Group 3- 30 subjects with duration >10 yrs

Data was analyzed and processed using EPI INFO statistical software using unpaired student t- test (two-tailed). The level of significance was taken as $p < 0.05$.

Results: The intergroup comparative analysis showed that p100 delay was statistically significant. Conclusion- we conclude that p100 latencies increased with the increasing duration of type 2 Diabetes.

Keywords- *Retinopathy, PRVEPs, Type 2 Diabetes, duration of Type 2 Diabetes.*

INTRODUCTION

Diabetes is an important public health problem. According to the World Health Organization, approximately 180 million people worldwide currently have type 2 DM (formerly called adult-onset diabetes); over 95% of people with diabetes have this form. The number of people with type 2 DM is estimated to double by 2030.[1]

Diabetes mellitus (DM) is characterized by a decrease in insulin production and/or sensitivity leading to a state of chronic hyperglycemia, which in turn results in vascular and nerve impairment. [2] Diabetic neuropathy is one of the most common causes of neuropathy worldwide.

It can affect either the peripheral or central nervous system. Though most of the clinical manifestations of peripheral neuropathy were identified during the second half of the nineteenth century, our understanding of the pathophysiology of central nervous system (CNS)

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abnormalities in type 2 diabetes mellitus is very little till date.

Retinopathy, which is a common complication of diabetes and the principal cause of blindness in the adult population [3] was usually considered a disease of retinal blood vessels. But it is now considered in a wider sense, as a neurosensory disorder.

The availability of sophisticated neurophysiological techniques to assess visual pathway, such as electroretinography and the measurement of brain electrical-evoked potentials, (VEPs) has increased our understanding of normal visual function and the possible effects that type 2 diabetes mellitus may exert. [4]

The visual evoked potentials (VEPs) are defined as changes in the bioelectric potentials of the occipital cortex evoked by visual stimuli. [5]They are generated by complex neurosensory events related to the translation and transmission of nerve impulses along the optic tract, from the photoreceptors to the occipital cortex. They can be elicited with pattern or with flash stimuli.

The present study focuses more on the correlation of P100 latency values among the different study groups since P100 is a prominent peak that shows reliability and reproducibility. It is generated in the striate and peristriateoccipital cortex due to the activation of the primary visual cortex and also due to the discharge of the thalamocortical fibers.[6]

This study is aimed at comparing the P100 latencies with varying duration of type 2 diabetes keeping the age and sex variables constant.

MATERIALS AND METHOD

A cross-sectional study was conducted after obtaining written consent from all subjects by using the Nicolet Viking Select neuro-diagnostic system version 10.0. [Viasys Healthcare, USA].The study was conducted after approval by the Institutional Ethics Committee and is in accordance with the Helsinki Declaration of 1975, as revised in 2000.Three groups (30 subjects each) of type-2 DM with different durations of disease were taken.

The groups were divided as:

Group 1- 30 subjects of type-2 DM with duration of <5 years.

Group 2 - 30 subjects of type-2 DM with duration of 5-10 years.

Group 3- 30 subjects of type 2 DM with duration of >10 yrs.

Patients with known history of type 2 diabetes mellitus either on treatment or discontinued treatment were taken as subjects .

Persons with any disorder affecting the visual pathway other than type 2 DM and persons with any eye condition grossly effecting vision were excluded from the study.

RECORDING TECHNIQUE

PRVEPS were recorded using 1 channel recording having 2 electrodes, placed according to International 10/20 system (EEG) after performing the ophthalmological examination.

A VEP monitor displaying checker board was used to give the pattern reversal stimulus. The frequency of the pattern reversal stimulus was set at 1.1 Hz The subject was asked to sit comfortably in

front of the checkerboard pattern at an eye screen distance of 100cm. An amplification which ranged between 20,000 and 1,00,000 was used to record the VEPs. The electrode impedance was kept below 5KΩby rubbing the areas of scalp where the electrodes are to be placed with NUPREP skin preparation gel.

The recordings were performed in a dark and sound attenuated room. Uniocular stimulation was given to both the eyes separately with a light-tight opaque patch placed over the unstimulated eye as the subject was asked to fix his vision at a point in the center of the pattern field. The test was run for two sets to ensure the reproducibility of signals and the responses averaged over 100 sweeps in each set.

The usual glasses (if any) were allowed to be put on during the test. The subject was instructed to avoid the usage of miotic or mydriatics drugs, 12 hours before the test. [6]

VEPs consist of a series of waveforms of opposite polarity, a negative waveform (denoted as N) and a positive waveform (denoted as P)

Waveforms (The NPN complex) [6]

The initial negative peak (N1 or N75)

A large positive peak (P1 or P100)

Negative peak (N2 or N145)

Data and statistical analysis

Data was analyzed and processed using EPI INFO statistical software using unpaired student t- test (two-tailed). The level of significance was taken as $p < 0.05$.

TABLE 1 - Demographic and clinical data of the participants

Parameters	Group 1	Group 2	Group 3
Age(years)	54 ±3	56 ±2	54 ±5
Duration of diabetes (yrs)	3 ±2	8 ±2	13±2
Fasting plasma glucose in (mg/dL)	142±28	150±48	168 ± 53
PRVEP Latency in (ms) for left eye			
N 75	66.28 ±4.21	68.20 ±2.54	68.32± 5.43
P100	112.4±2.34	114.42.±3.34	122.54±2.38
N145	134.45 ± 3.82	130.23 ± 5.22	138.22±2.34
PRVEP Amplitude in (µV) for left eye			
N75-P100	8.23±2.43	8.36±2.58	8.92±2.48
P100-N145	7.86 ± 2.2	6.67±3.2	7.64±2.36
PRVEP Latency in (ms) for right eye			
N75	65.26±4.56	67.37±2.43	68.45±3.33
P100	111.12±1.63	113.02±3.24	121.54 ±2.45
N145	132.42 ± 2.68	128.22 ±2.42	130.22 ±2.64
PRVEP Amplitude in (µV) for right eye			
N75-P100	7.24 ± 2.45	8.12 ±2.82	8.42 ±3.42
P100-N145	8.46±3.45	7.42±3.43	8.14 ±3.53

NS- NON SIGNIFICANT; S- SIGNIFICANT; HS- HIGHLY SIGNIFICANT.

TABLE 2- p –value (Intergroup comparison of right eye PRVEP parameters)

Latencies	Group1 vs. Group2	Group2 vs. Group3	Group3 vs. Group1
N75	0.0292	0.1567	0.003
P100	0.0057 HS	0.0001 HS	0.0001 HS
N145	0.0001	0.0034	0.0022
AMPLITUDES			
N 75-P100	0.2021	0.7122	0.1299
P100-N145	0.2509	0.4263	0.7238

NS- NON SIGNIFICANT; S- SIGNIFICANT; HS- HIGHLY SIGNIFICANT.

TABLE-3 p –value (Intergroup comparison of left eye PRVEP parameters)

Latencies	Group1 vs Group2	Group2vs Group3	Group3vs Group1
N75	0.03	0.91	0.1
P100	0.0088 HS	0.0001 HS	0.0001 HS
N145	0.0007	0.0001	0.0001
AMPLITUDES			
N 75-P100	0.8415	0.3949	0.2809
P100-N145	0.0986	0.1867	0.7102

NS- NON SIGNIFICANT; S- SIGNIFICANT; HS- HIGHLY SIGNIFICANT

RESULTS

The mean value and standard deviations of the PRVEP parameters of the left and right eyes in the three groups of the diabetic subjects of variable duration are shown in the table1.

On statistically analyzing the mean values of the PRVEP parameters and focusing on the p100 values results obtained are as follows-

The mean value of P100 latency was increased in all diabetic groups .

The inter group comparison of P100 values in left and right eye showed that the p-value was statistically significant in all groups but more so in group 2 vs. group 3 and group 3 vs. group 1.

DISCUSSION

Recording visual evoked potentials in response to pattern reversal stimuli is a very sensitive test for detecting any abnormality of anterior visual pathways.[7] The visual neurons respond selectively to visual patterns of progressively greater complexities .[8]

The present study focuses more on the correlation of P100 latency values among the different study groups

since P100 is a prominent peak that shows reliability and reproducibility. It is generated in the striate and peristriateoccipital cortex due to the activation of the primary visual cortex and also due to the discharge of the thalamocortical fibers.[6]

In our study, a significant correlation of the delay in the P100 latency with the increased duration of diabetes, corroborated with the findings of Azal O et al [9]and Li P et al, [10]but not with the findings of Szabela D et al, [11] who observed that the delay in the P100 latency was stable in long standing diabetics.

Our findings signify that there is a definite involvement of central nervous system in early stages of type 2 diabetes mellitus, and it increases with an increased duration of the disease.

The pathophysiology of the central nervous dysfunction seems to be multifactorial, involving metabolic and vascular factors, which is similar to the pathogenesis of diabetic peripheral neuropathy. Ischemia, reduced protein synthesis, depleted myoinositol, and high sorbitol levels have been demonstrated in patients with diabetes and these may result in nerve fibre loss in the peripheral nerves.[12]

Hence, it is possible that the optic nerve fibers may also suffer from these diabetes induced changes. Kamijoet al [13] have demonstrated from animal studies that axonal atrophy and axonal dysfunction are the two structural lesions that occur in optic neuropathy of diabetes . Further , the increase in P100 latency may indicate either retinal dysfunction or dysfunction in the retinocortical conduction pathways.

CONCLUSION

VEP measurement is a highly sensitive, reliable, noninvasive and reproducible method for detecting the early alterations in the central optic pathways in diabetics.[10]It helps to assess the integrity of the visual pathway.[14] There is an increase in P100 latency with the increased duration of diabetes. Therefore proper control of type 2 DM goes a long way in delaying the central neuropathy changes.VEP measurement should be recommended and added to the list of screening tools for a more complete and early assessment of the neurological involvement of the diabetic patients to advise them for an early and proper management of the disease.[15]

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Effect of Handedness on Sensory and Motor Nerve Conduction Velocity

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ABSTRACT

Background: Nerve conduction velocity is very important diagnostic test for number of diseases. However knowledge of effect of various physiological factors on nerve conduction velocity can sub serve or may even change the current trend of diagnosis.

Objective: To compare nerve conduction velocity of Peripheral nerve in right and left handed subjects.

Methodology: Study carried out among 64 male healthy individuals of the age between 17–25 years. 32 subjects were right handed and 32 were left-handed. Sensory and motor nerve conduction velocity measured in median nerve of dominant and non dominant upper limb of all the individuals. Data were analyzed by applying suitable statistic test.

Results: Motor nerve conduction velocity among right hander's right and left hand were 66.02 ± 0.84 and 65.52 ± 1.49 (mean $\pm$ SD) respectively while that of the left handed 61.85 ± 1.15 and 62.38 ± 1.48 respectively ($p<0.05$). Sensory nerve conduction velocity among right hander's right and left hand were 63.53 ± 1.29 and 64.11 ± 1.26 respectively while that of the left handed 67.50 ± 1.46 and 68.09 ± 1.95 respectively ($p<0.05$).

Conclusion: Motor nerve conduction velocity in right handed subjects is more as compared to left handed. Sensory nerve conduction velocity is higher in left handed as compared to right handed.

***Keywords:** handedness, motor, sensory, nerve conduction velocity.*

INTRODUCTION

Electro diagnostic (EDX) studies play a key role in the evaluation of patients with neuromuscular disorders. These studies are nerve conduction studies (NCSs), repetitive nerve stimulation, late responses, blink reflexes, and needle electromyography (EMG), in addition to a variety of other specialized examinations. NCSs and needle EMG form the core of the EDX study. These studies are performed first and usually yield the

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greatest diagnostic value. The information gained from NCSs often leads to specific medical or surgical therapy.

NCSs and EMG are most often used to diagnose disorders of the peripheral nervous system these include disorders affecting the primary motor neurons (anterior horn cells), sensory neurons (dorsal root ganglia), nerve roots, brachial and lumbosacral plexuses, peripheral nerves, neuromuscular junctions, and muscles;[1] however knowledge of effect of various physiological factors on nerve conduction velocity (NCV) can sub serve or may even change the current trend of diagnosis.

There are anatomical and physiological aspects to nerve conduction velocity. The conduction velocity of the nerve depends on the fiber diameter, degree of myelination and the intermodal distance. Age,

temperature, height, gender like physiological variables also affect nerve conduction study.[2] Use of conduction velocity measurement as a diagnostic procedure in neurology requires knowledge of the range of values encountered in healthy individuals. Normal value for conduction velocity in human median nerve is 61.0±5.1m/sec as described by Helmholtz in 1850 with the help of mechanical insruments.[3]

Hemispheric specialization is related to handedness. Handedness appears to be genetically determined. In 96% of right handed individuals (91% of total human population), the left hemisphere is the dominant or categorical hemisphere, and in remaining 4% right hemisphere is dominant. In approximately 15% of left handed individuals, the right hemisphere is categorical and in 15% no clear lateralization. In the remaining 70% of left handers, the left hemisphere is categorical hemisphere. [4]

From the above information, we can expect that there may be change in nerve conduction velocity due to lateralization. So far, not much data has been collected on the values of motor and sensory nerve conduction taking handedness aspect into consideration. In our present study, we have compared motor and sensory nerve conduction in the median nerve of right handed subjects with their counterparts left handed so as to have a normal set of reference values. Currently same reference data is used for left handed and right handed patients.

AIMS AND OBJECTIVES

Study and comparison of motor and sensory nerve conduction velocity among left and right handed subjects.

To set standard reference value of nerve conduction velocity separate for each limb if any significant difference is found.

MATERIAL AND METHODOLOGY

We conducted experimental cross sectional study at department of physiotherapy, janardan rai nagar university Udaipur. 64 healthy male individuals of the age between 17–25 years were recruited for the study.32 subjects were right handed and 32 were left-handed. Written informed consent from the participants and ethical approval from the institute ethical committee were taken before commencing the study.

Inclusion criteria:

Healthy male individuals aged 17-25years.

Dexterity:- uni-dextrous persons only (Ambidextrous were excluded)

Exclusion criteria:

Symptoms of abnormal sensation or numbness

Subjects with metabolic and other related systemic diseases

Peripheral nerve injury

Radiculopathy

Cervical spondylosis

History of medication affecting neuromuscular system.

Tremor, ataxia, muscle weakness, wasting of muscles

Handedness of an individual was determined by the Edinburgh Handedness Inventory. [5] All the subjects were acclimatized in air-conditioned room at 25 °C before commencing NCV. Motor and Sensory Nerve conduction studies performed on median nerve of each subject by using surface electrodes with supramaximal technique using nerve conduction velocity instrument, NIHON COHDEN with neurocare software.

To measure NCV median nerve was externally stimulated, that initiates depolarization simultaneously in all axons of the nerve to produce a recordable response. The response is recorded by stimulating the nerve at two different points. Conduction velocity is determined by studying the difference in latencies of the responses, compared with the distance between two points. The nerve conduction study involves study of motor and sensory conduction. Following settings of the instrument were set for motor NCV: Gain/sensitivity: 2-5 mV/mm, sweep speed: 2-5ms/mm, filter: 2-5 Hz (low frequency), 10 KHz (High frequency) and for sensory NCV: Gain/sensitivity: 10-20 μV/mm sweep speed: 1-2 ms/mm Filter: 5-10 Hz (low frequency), 2-3 KHz (High frequency).

Statistical analysis: Values expressed as means ± SD. Microsoft® Office Excel® 2007 (© 2006 Microsoft Corporation, USA) and EPI INFO were used for data analysis. Comparison between each group was done by T test. The probability level for significance was set at $P < 0.05$.

RESULTS

Table 1: Demographic profile

	Right handed	Left handed
Age	22.36 ± 0.48	22.20 ± 0.79
Height (CM)	160.38 ± 1.96	161.10± 1.58

Table 2: Comparison of Motor nerve conduction velocity (MNCV) in RIGHT AND LEFT HANDED subjects.

	RIGHT HANDED MNCV (m/s) (Mean ± SD)	LEFT HANDED MNCV (m/s) (Mean ± SD)
Right hand	66.02 ± 0.84*	61.85 ± 1.15
Left hand	65.52 ± 1.49*	62.38 ± 1.48

*P< 0.05

TABLE 3: Comparison of Sensory nerve conduction velocity (SNCV) in RIGHT AND LEFT HANDED subjects.

	RIGHT HANDED SNCV (m/s) (Mean ± SD)	LEFT HANDED SNCV (m/s) (Mean ± SD)
Right hand	63.53 ± 1.29	67.50 ± 1.46*
Left hand	64.11 ± 1.26	68.09 ± 1.95*

*P<0.05

DISCUSSION

We compared the sensory and motor nerve conduction velocity among right and left handed individuals. We found nerve conduction velocity is greater in right handed subjects as compared to left handed individuals (table 2). This difference was found to be statistically significant (p<0.05). Studies done by Jagad BK et al[6], Tayade MC et al [7], Navin G et al [8] found no such effect of handedness on motor nerve conduction velocity. However Harinder et al [9] and Bhorania S et al [10] found results similar to our study. Handedness is primarily because of dominance of specific cerebral hemisphere; although peripheral factors may also be involved. Genetic theory is most widely accepted in explaining the onset of lateralization [11]. Corballis proposed the emergence of 'dextral' (D) allele with evolution *of* Homo sapiens in Africa [12]. He proposed that this along with other probable genes might be responsible for laterality. Another possible reason for high motor NCV in right handed could be because motor neurons of spinal cord supplying right upper limb are larger as compared with motor neurons supplying the left upper limb in right handed. [13]

We also noted sensory NCV is more in left handed as compared to right handed (table 3, p<0.05). This difference should be taken into account before making any neurological diagnosis in left handers. Similar results also obtained by Navin G et. al.[8], Tayade MC et al.[7], Tan U [14]. Higher sensory conduction velocity in left handers may be because of genetic reasons.

CONCLUSION

Motor nerve conduction velocity in right handed and sensory nerve conduction velocity in left handed are more as compared to their counterparts. This finding suggests that there must be separate set of normative data for both right and left handed individuals to be used in practice. If the same set of reference values is used for all individuals, the chances of error in diagnosing will increase and a normal healthy individual would wrongly be labeled as a patient suffering from nerve disorder.

Conflict of Interest: none

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Effect of Regular Aerobic Exercise on Physical Fitness Index

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ABSTRACT

Introduction: Determination of physical fitness index (PFI) is one of the important criteria to assess the cardiopulmonary efficiency of the subject. Medical colleges in India are stuffed with lot of academic syllabus which makes the students to lead a sedentary life, whereas physical education course includes regular physical training for students. Hence the present study was undertaken to compare the Physical Fitness Index between medical education students and physical education students.

Methodology: Study was conducted on 50 healthy male medical students and 50 healthy age matched male physical education students. Physical fitness index of each subject was recorded by using Astrand-Ryhming step test (ARST).

Results: The comparison of mean±1SD duration of exercise and PFI between students of ME and PE showed that the scores were more in PE students when compared to ME and all the differences were statistically highly significant.

Conclusion: Hence, it can be concluded that, regular physical exercises should be a part of even medical education which not only improves physical fitness and health but also will improve their academic performance.

Keywords: Physical fitness index, medical, Physical education, Training.

INTRODUCTION

Regular physical exercise is known to have beneficial effect on health. Realizing the fact that diseases are related to lack of fitness, a need to counteract a sedentary lifestyle with planned physical activity through sports and formal exercise is required.[1] The sedentary life style presents a major public health challenge that must be met in order to prevent obesity and thus enhance health and well-being.[2]

Determination of physical fitness index (PFI) is one of the important criteria to assess the cardiopulmonary efficiency of the subject. The American Alliance for Health, Physical Education, Recreation and Dance

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recommended this test to study health related physical fitness programme in youth.[3]

Assessment of physical fitness of sedentary and physically active male college students by modified Harvard step test suitable for Indian subjects by Bondyopadhyay B et al in 1981 has shown that, mean PFI score to be significantly higher in the physically active group than sedentary group of students.[4] A previous study by Banerjee et al (1970), Banerjee and Chatterjee (1983), Das et al (1988) and Mahanta et al (2001) reported that physically inactive subjects have a lower PFI score.[5]

Pramanik T et al in a study on physical fitness status among the students of a medical college in Kathmandu, Nepal have found that most of the medical students had good, poor and average PFI scores and suggested that medical students can keep themselves physically fit and mentally alert through regular physical training in their leisure time.[6]

Medical colleges in India are stuffed with lot of academic syllabus which makes the students to lead a sedentary life, whereas physical education course includes regular physical training for students. Hence the present study was undertaken to compare the Physical Fitness Index between medical education students and physical education students.

METHODOLOGY

Source of Data

Study was conducted on 50 healthy male medical students and 50 healthy age matched male physical education students, after completion of 9 months of course in the college. Ethical clearance was obtained from the institutional ethical committee. Details of study were explained and a written consent was taken from subjects.

Recording of physical fitness index by using Astrand-Ryhming step test: [7,8,9,10]

Physical fitness index of each subject was recorded by using Astrand-Ryhming step test (ARST). Each subject completed step 'up' and 'down' task at the rate of 90 steps per minute (22.5 cycles/min) on 40 cm bench (16 inch) for 5 minutes or until exhaustion (when the subject can not maintain the stepping rate for 15 seconds), which ever was early. The subject placed one foot on the platform and later the other, and immediately stepped down, bringing down first the same foot which he placed up first. The rate of stepping at 90 steps per min was maintained with the help of a metronome. Pulse counts for 30 seconds were recorded at 1-1.5 min, 2-2.5 min and 3-3.5 min after ARST in the recovery period. Pulse counts were recorded as PC1, PC2 and PC3 respectively.

The physical fitness index (PFI) was calculated as follows:

$$\text{PFI} = \frac{\text{Duration of exercise in seconds} \times 100}{2 \times (\text{Sum of pulse counts at 1-1.5 min, 2 to 2.5 min and 3 to 3.5 min})}$$

STATISTICAL ANALYSIS

Data was analyzed by following statistical methods.

1. Unpaired 't' test.

2. Chi-square test.

All the statistical operations were done through SPSS for Windows (Version 16. Chicago). P>0.05 was considered statistically not significant (NS) and P<0.05

was considered statistically significant (S). P<0.001 was considered statistically highly significant. Graphs were made to portray the relation existing among data wherever necessary.

RESULTS

Table-1, show the comparison of mean±1SD duration of exercise and PFI between students of ME and PE. All the scores were more in PE students when compared to ME and all the differences were statistically highly significant.

Table-1: Comparison of Duration of exercise and Physical Fitness Index between students medical and physical education.

Parameter	Medical Education Mean ± SD	Physical Education Mean ± SD	t value	p value	Remark
Duration of exercise(sec)	269.4±43.6	296.1±11.8	4.18	<0.001	HS
PFI	74.7±13.4	96.6±9.0	9.19	<0.001	HS

HS-Highly significant

Table-2 and Graph-1, show the comparison of PFI scores of students of ME and PE. Most of the students of PE had excellent and good PFI scores where as most of students of ME had good, average and low average PFI scores. The differences in PFI scores between PE and ME students were statistically highly significant.

Table-2: Comparison of PFI scores of medical and physical education students.

Score	Medical Education. Number of students (%)	Physical Education. Number of students (%)	Chi – square Value	p value	Remark
Excellent	1 (2.0)	20 (40)	55.32	<0.001	HS
Good	12 (24)	28 (56)	55.32	<0.001	HS
Average	25 (50)	1 (2)	55.32	<0.001	HS
Low average	6 (12)	1 (2)	55.32	<0.001	HS
Poor	6 (12)	0(0)	55.32	<0.001	HS

HS-Highly significant

DISCUSSION

In the present study, ME students were over loaded with academic activities and were left with no time for physical activities, where as all the PE students gave history of regular exercise in the past 9 months of about 4 hours/day for six days a week as it was compulsory in their curriculum itself.

The present study revealed a significantly higher PFI in PE students (96.6±9) than ME students (74.7±13.4). The mean duration of exercise in ARST was also significantly more in PE students (296.1±11.8 sec) than ME students (269.4±43.6 sec). PFI scores of most of PE students were excellent to good while most of ME students scores were in average to good range.

 In agreement with the findings of present study, Bandyopadhyay B et al have reported a significantly higher mean PFI scores in the physically active college students when compared to sedentary students by a modified Harvard step test.[4]

Another study done among rural farmers and urban sedentary male subjects of 20-30 yrs, revealed a significantly high PFI score of 75.1±3.10 in physically active farmers and a low PFI score of 60.9±3.90 in urban sedentary group.[11]

A study on Physical fitness status using step test in medical students in Kathmandu, Nepal by Pramanik T et al in 1993 has reported that, majority of the medical students (39.6%) had good fitness, 10.4% had poor physical fitness and 23.6% had average fitness. Only a minority had excellent or very good fitness. (8.5% and 17.9% respectively). Medical students who are under constant mental pressure because of their demanding course can keep themselves physically fit and mentally alert and improve their fitness through regular physical training in their leisure time. [6]

Physical fitness index score of college going students was reported to be in poor to average range in a study by Hasalkar et al.[12]

Various other studies by different researchers also have revealed a higher PFI score in trained/physically active subjects than sedentary subjects. [13,14,15]

A high mean PFI and better PFI scores in PE students can be explained by training induced significantly higher VO_2 max, significantly lower resting pulse rate and significantly faster pulse recovery in them when compared to ME students.

A review on the association between school based physical activities and academic outcomes revealed, a positive association between academic performance and physical activity. [16]

Hence, it can be concluded that, regular physical exercises should be a part of even medical education which not only improves physical fitness and health but also will improve their academic performance.

Source of Funding: Self

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Prevalence of Gene Frequency in Haemoglobinopathies and Blood Groups in Uttarakhand

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ABSTRACT

Various haemoglobinopathies are mutant form of haemoglobin disorders within a population, which is due to genetic mutations in specific genes or globins that cause changes or alterations in the amino acid sequence in α or β chains. Haemoglobin variants, major blood groups and Rh factor are liable to vary from individual to individual. Therefore, it is a need of time to rule out the frequency of these indices in Uttarakhand, India. Such genetic study will create a platform for instituting genetic counseling services with a view to reduce haemoglobinopathies. A sum total of 933 subjects aged 01 to 30 years were screened and analysed that 615 (six hundred fifteen) were males and 318 (Three hundred and eighteen) were females. Result of present study showed 4.2% prevalence of haemoglobinopathies. Out of total haemoglobinopathies screened subjects (41), β-thalassemia trait (30) was screened as highest followed by sickle cell trait (6), β-thalassemia major (3), HbS-D (1) and HPFH/Thal (1). The frequencies with respect to ABO and Rh blood group systems is shown as B>A>AB>O. The distribution of blood groups with 97.6%. Rhesus positive (Rh+) out of which B+ is 15 (36.5%), A+ 6 (14.6%), AB+ 6 (14.6%) O+ 13 (31.7%) found respectively.

Keywords: *ABO, blood groups, haemoglobinopathy, agarose gel electrophoresis, high performance liquid chromatography, amplification refractory mutation system.*

INTRODUCTION

Within a population there are numerous forms haemoglobinopathies. These altered haemoglobins are due to genetic mutations in specific genes or globin that results in changes or modifications in their amino acid sequences. These all means leads to manifest a clinical representation from asymptomatic clinical findings to death in utero. Haemoglobinopathies are eventually a wide spread prevalence throughout the world but relatively more often represents in multicultural or mixed populated states.

Altered haemoglobin varients, Blood group (ABO) & Rhesus blood groups (Rh) are known to vary from one population to another. Thus there is need to elucidate the various types of gene frequency prevalent in North India population particularly Uttarakhand, India. Such genetic studies results as a background for initializing genetic counseling services with a view to reduce haemoglobinopathies.

AIMS AND OBJECTIVES

OBJECTIVES:- To access the relationship between blood groups and hemoglobion patterns.

AIM:- To investigate the Haemoglobinopathies / abnormal Haemoglobin bands in north India population, particularly Uttarkhand.

REVIEW OF LITERATURE

There are various disorders of haemoglobin, which is present inside erythrocytes and transports blood gases in the body. Genetic disorders of haemoglobin

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leads to abnormal haemoglobins which leads to "Haemoglobinopathies". These abnormal state of haemoglobin can leads to any one of these situations either diminish creation of one of the globin chain i.e. thalassemia or an abnormal globin chain i.e. sickle cell disease [1,2,3].

During haemoglobin synthesis, because of inherited disorder β-thalassemia occurs which is shown by reduction of (β⁺) or absence (βᴼ) of synthesis of beta globin chains of haemoglobin. This overall leads to weakened and damaged chain synthesis, which ends up the intensity of the disease[4].

The universality of β-thalassemia trait is about 3.3% in India[5]. According WHO report, about 3,70,000 severely affected homozygotes or compound heterozygotes of thalassemia are born every year[6]. The study by UNICEF in 1996 estimated that there were 29.7 million carriers of β-thalassemia trait in India and about 10,000 infants with homozygous β-thalassemia born every year[7].

In various parts of India, the prevalence of β-thalassemia in logical means not identical, which is 6.5% in Punjab, 8.4% in Tamil Nandu, 4.3% in south India and 3.5% in Bengal[12,13,14]. B-thalassemia is having a high prevalence in some communities such as Sindhi, Luvana, Tribes and Rajputs. The incidence of β-thalassemia in Gujarat is 10% to 15%. They source average to drastic hemolytic anemia guiding to lofty grade of anaemia mortality and morbidity. The occurences of β-thalassaemia in India extent from 3.5 to 15 % in widespread community[8]. In India, nearly 30 million people are carriers of β-thalassemia and 7000 babies with β-thalassemia major are born every year[9]. The carrier rate of β-thalassemia varies between 0 to 17% in different ethnic groups[10]. India across with many other figurative countries are routinely widespread for inherited haemoglobin disorders. The routine cycles for β-thalassemia scale between 3-17% to that of sickle cell haemoglobinopathy is 1-44%, this state is due to larger mixing of populance, many types of ethnical groups and features of locality limits, regardless some racial groups depicts high occurence which forms this disease a major public and genetic health problem in India[11, 12].

Odisha constitute a wide degree of separation of multiple racial and ethnical groups in which of total 36.7 million people schedule casts holds 16.2% and schedule tribes holds 22.4% of its allocation. Widespread impoverishment, ignorant, undernutrition, lack of potable water and very poor sterile conditions along with devitalize maternal and child health services, feeble lineage of state and national health programmes are the major contributor of exhausting health services in Odisha. Another concomitant factor to this situation are many like different socio-cultural customs and beliefs, marriage practices and varient life style which differentiate from one another, so this effects the vulnerability towards this fatal hereditary diseases in eastern coastal region of India[13].

MATERIAL AND METHOD

SUBJECT SELECTION

The present study was carried out in the Department of Physiology at Dolphin (PG) Institute, Dehra Dun (UK) during the period of January 2013 to April 2017. A sum total of 933 study participants were selected by random sampling after obtaining the consent from the participants. The age were between 1 year to 30 years.

MATERIAL

STUDY AREA: In this research, starting with sample collection along with its processing at various stages of its investigations the present work was carried out in the Department of Physiology, Dolphin (PG) Institute, Dehradun, in collaboration with in SGRR Institute of Medical Sciences, Dehradun (UK).

NUMBER OF CASES: A total of 933 cases were included in the study for detection of Thalasemic cases. Out of these only 41 cases were found positive, whose gene frequency were detected.

STUDY PERIOD: 3 Years

INCLUSION CRITERIA

Volunteers for this study having suspected case of hemolytic anemia.

Subjects more then 01years and less then 30 years.

EXCLUSION CRITERIA

Volunteers more than 30 years and less than 01 years.

Volunteers having any respiratory/inflammatory diseases.

METHODOLOGY

BLOOD SAMPLE COLLECTION AND PREPARATION

Total 6 ml venous blood was collected in EDTA vials and few drops of fresh whole blood was placed on slides for blood group investigation. The anticoagulant blood was used for performing CBC/Red cell indices, haemoglobin electrophoresis HPLC. Rest of the 2 ml of blood will be retained in EDTA vial and stored at -20^0C for genotype DNA analysis.

BLOOD GROUP IDENTIFICATION

ABO and Rhesus blood grouping were carried out using the slide method. One drop of whole blood of each subject was mixed with respective antisera, Anti A, Anti B, Anti D reagents (Tulip Diagnostics (P) Ltd., Goa, India).

COMPLETE BLOOD COUNT

CBC – Haemotological indices were measured using sysmex XP series fully automated blood cell counter, which was caliberated with commercially available controls.

HAEMOGLOBIN ELECTROPHORESIS

Different type of haemoglobin testing system provides an integrated method for separation and determination of relative percent of specific haemoglobins (eg A_2, F, Ao) in whole blood. The separation is based on the principles of high performance liquid chromatography (HPLC), by (Bio0Rad D-10) haemoglobin testing system.

GENE POLYMORPHISM

Polymorphism studies will be carried out using Amplification Refractory Mutation System (ARMS) method. 'The study will be conducted at in the Department of Bio-chemistry, Central Molecular Research and Diagnostic Laboratory, SGRRIM&HS, Dehradun (Uttarakhand)'.

Table-1: Sex wise distribution of patients with different haemoglobinopathies (n=933)

Gender	HbAA	HPFH/Thal	HbS-D	Hb-AS	HbβTT	HbβT Major	Total
Male	588	1	0	4	20	2	615
Female	304	0	1	2	10	1	318
	892	1	1	6	30	3	933

Table-2: Dissemination of ABO and Rh blood group in the study population (n=933)

Blood Group	Male		Female		Total		Total
	Rh$^+$	Rh$^-$	Rh$^+$	Rh$^-$	Rh$^+$	Rh$^-$	
A	138	42	90	38	228	80	308
B	176	40	60	33	236	73	309
AB	68	52	50	19	118	71	189
O	58	41	16	12	74	53	127
Total	**440**	**175**	**216**	**102**	**656**	**277**	**933**

Table-3: Distribution of different haemoglobinopathies in accordance with blood group in study population (n=41)

Blood Group	Haemoglobinopathies (n=41)					
	Male	%	Female	%	Total	%
A+	3	7.3	3	7.3	6	14.6
B+	12	29.2	3	7.3	15	36.5
AB+	4	9.7	2	4.8	6	14.6
O+	11	26.8	2	4.8	13	31.7
B-	1	2.4	0	0	1	2.4

Table-4: Frequency of ABO Rh blood group in Abnormal Haeoglobin varients (n=41)

Variables Blood Group	No. Observed	Prevalence (%)
A	6	14.6
B	15	36.5
AB	6	14.6
O	13	31.7
Rhesus (RH)		
D+	40	97.5
D-	1	2.4

Table-5: Frequency of mutation detected in Abnormal Haemoglobin varients (n=41)

Mutation Detected	No. of Patients Detected with Mutation	Frequency (%)	Amplified Product Size (bp)
IVS1-5(G→C)M	24	58.5	285
619bp detection	06	14.6	242
Fr8/9 (+9)M	05	12.1	215
Codon41/42 N (TCII)	06	14.6	438

OBSERVATION AND RESULT

An aggregate of 933 patients were analysed for abnormal haemoglobin variants, ABO & rhesus blood groups. Out of the total 933 subjects 615 were males and 318 were females.

Table 1 indicates different patterns of haemoglobin variants according to the gender. Out of 933 subjects, I found 892 with normal (HBAA) and 41 subjects with abnormal haemoglobin variants on haemoglobinopathies viz. β-Thalessemia Major, Trait, Sickle Cell Trait, Hereditory Persistence of foetal haemoglobin and S-D disease.

In this study, total observed abnormal haemoglobinopathy (41) in which the most frequent haemoglobinopathy was β-Thalessemia trait (30) Sickle cell trait (6) while less frequent in β-T major (3), HPFH/thalassemia (1) and S-D(1).

Table 2 depicts the dispersal of the blood group (ABO) & Rhesus (D) between study subjects. Blood group B was observed as the majority frequent 309

while blood group O was least frequent 127.

In Rh (D) blood typing 656 was Rh positive and 277 was Rh negative. Amongst Rh positive male blood group B (176) was observed as the most prevalent blood group proceeding ahead by blood group A (138), AB (68), O (58).

Between Rh positive female, blood group A (90) was most common followed by blood group B (60), AB (50) & O (16).

The frequencies pattern with respect to ABO can be shown by B>A>AB>O in males and A > B > AB > O in females.

Table 3 shows the prevalence of blood group with observed haemoglobinopathies. The present study show that haemoglobinopathy was most frequent in Rh positive B (36.5%) followed by Rh positive O (31.7%), Rh positive AB (14.6%), Rh positive A (14.6%), Rh negative B (2.4%).

The study of ABO blood group is an important factor in determining the direction of recruitment of voluntary donars as required for that region of the country. In my observation the ABO blood group and Rh positive in male & female in observed haemoglobinopathies (41) depicts that the blood group B and O positive was most prevalent in male followed by AB & A. On analysis individually in males the sequence of ABO and Rh positive falls in decreasing sequences as B and O proceeding ahead by blood group AB and A. Blood group B and A positive female followed by blood group O & AB.

Table 4 shows that blood group B is observed maximally with 36.5% followed by blood group O (31.7%), AB (14.6%) & A (14.6%). Out of these Rh + were 40 (97.5%) & Rh- is 1 (2.4%).

Table 5 depicts the spectrum of β-Thalalssemia mutations in north india population (uttarakhand) within this study a total of 41 β-Thalalssemia alleles have been deciphered out of 933 individuals in Uttarakhand population. After screening with ARMS PCR, the amplicons were subjected for gel electrophoresis with 1.6% as agarose. The product were visualized under UV transmitter for the DNA bands. Screening for 04 different types of β-Thalassemia mutations were observed i.e. IVS 1 – 5 (G-C)M, as most common, followed by 619 bp deletion, Fr 8/9 (+G)M and codon 41/42 N (TCTT), at 285 bp, 242bp, 215 bp and 438 bp respectively. (As

shown in gel pictures) this accounts for 58.5%, 14.6%, 12.1% and 14.6% respectively.

DISCUSSION

The sequel of abnormal haemoglobinopathies are moreover autocomal recessive disorders and are genetically inherited through one or both parents who might be the carrier or suffering in another presentable form with the disease.

An composite of 933 patients of different ages, ranging from 01 year to 30 years, considering that these all are residing in multicultural society, were avalysed for abnormal haemoglobin varients in amalgamation with ABO and rhesus groups. So, out of these 933 randomised choosen subjects in which 615 were males and 318 were females.

SUMMARY & CONCLUSION

This different type of haemoglobinopathies and particularly thalassemia are the largest number of genetic disorder which causes great public health disorder and are of clinical importance since birth. During the synthesis of haemoglobin this inherited disorder is of public health importance in Uttarakhand region. In this study of haemoglobinopathies indicates the genetic heterogenecity of the population of this region. In the passage of time several ethanic group and communities might have been mixed into the mainstream population which has led to varied genetic consequences. This is to ideally stated that the prevalence of varied haemoglobinopathies in this region are in agreement with the population admixture in Uttarakhand.

The outcome for the study of abnormal haemoglobin varients, ABO and Rhesus when a total of 933 patients were taken into consideration. It consisted of 615 males and 318 females.

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Visual Evoked Responses in Type I and Type II Diabetes

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ABSTRACT

Introduction: Diabetes mellitus is a heterogenous group of metabolic disorders characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. **Materials and Method:** This is a combined cross sectional and case control study. This study was carried out in the Research laboratory of the department of physiology, Coimbatore medical college, Coimbatore. The approval of the ethical committee was obtained prior to the commencement of the study. A total of 80 subjects were included in the study of which 40 were diabetic patients, both type 1 and type 2 and 40 were control groups. They were of 30 – 70 years of age group. Group I includes 40 controls of age and sex matched healthy individuals. Group II includes 40 diabetic patients. Group II $_A$ includes 20 type I diabetic patients. Group II $_B$ includes 20 type 2 diabetic patients. . Neuroperfect EMG 2000 system and Autoanalyser are the materials used for the study. Pattern–shift visual evoked potential test was performed in a specially equipped electrodiagnostic procedure room. **Results:** One way ANOVA & Student 't' test were used to assess the statistical significance. The mean value of the P_{100} latency was significantly delayed in Group II $_A$ and Group II $_B$ patients as compared to that in Group I subjects. **Conclusion:** The delay in P_{100} latency was observed in diabetic patients before the development of overt retinopathty.

Keywords: Type I and Type II diabetes mellitus, visual evoked potentials, P100 latency, diabetic retinopathy

INTRODUCTION

Diabetes mellitus is characterized by chronic hyperglycemia resulting from defects in insulin secretion or insulin action. Diabetes mellitus are of two types. Type I diabetes is characterized by the presence of auto antibodies that causes beta cell destruction which is rapid in infants and children and slower in adults[1]. Type II diabetes is associated with progressive beta cell failure and frequently goes undiagnosed for many years[2]. Both type of diabetic patients are at high risk of developing microvascular and macrovascular complications. Visual evoked potentials are evoked potentials occur in response to visual stimuli. Visual evoked potentials gives us information about the physiology of anatomical pathways and visual cortex.

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MATERIALS AND METHOD

This is a cross sectional study. This study was done in the Research laboratory of the department of physiology, Coimbatore medical college, Coimbatore. Ethical committee clearance was obtained prior to the commencement of the study. A total of 80 subjects were included in the study of which 40 were diabetic patients, both type 1 and type 2 and 40 were control groups. They were of 30 – 70 years of age group. All the cases of diabetic mellitus were taken from diabetic clinic of Coimbatore medical college hospital and the controls were taken from the general population. The study subjects of both sexes were divided in to two groups. Group I includes 40 controls of age and sex matched healthy individuals. Group II includes 40 diabetic patients. Group II $_A$ includes 20 type I diabetic patients whose HbA1c $\leq$ 7% or > 7% were assessed. and Group II $_B$ includes type II diabetic patients whose HbA1c $\leq$ 7% or $\geq$ 7% were assessed in order to assess the relation between long term glycemic control and altered VEPs. Group II $_A$ and Group II $_B$ patients were

also assessed based on the duration of diabetes. Patients with history of hypertension, retinopathy, glaucoma and cataract were excluded. Neuroperfect EMG 2000 system and Autoanalyser are the materials used for the study. Pattern–shift visual evoked potential test was performed in a specially equipped electrodiagnostic procedure room.The patients were explained about the test and should avoid hair spray or oil before the test .The patients were seated comfortably one meter away from the pattern – shift screen. Subjects were placed in front of a black and white checker board pattern displayed on a video monitor. Standard silver chloride electrodes were used. The electrodes were applied to the scalp using conduction jelly after thoroughly cleaning the area. Recording electrode was placed at Oz position, reference electrode was placed at Fz and the ground electrode at M1 position using conduction jelly. Every time the pattern changes , patient's visual system generates an electrical response which was detected and recorded by surface electrodes. The patient was asked to focus his gaze on to the center of the screen. Each eye was tested separately, while the other eye was being covered with an opaque patch.

RESULTS

One way ANOVA & Student 't' test were used to assess the statistical significance. The results showed that P_{100} latencies were significantly prolonged in Group IIA and Group IIB patients whose HbA1c > 7% (Table – 3). The N_{75} latencies in both Group IIA and Group IIB showed prolongation with poor glycemic control (HbA1c > 7%) but the statistical significance could not be demonstrated .(Table – 3). The N_{145} latencies and $N_{75} – P_{100}$ amplitude in both Group IIA and Group IIB patients were not prolonged with poor glycemic control. (Table – 3). A positive correlation was found between prolonged P_{100} latencies and glycemic control in Group IIA and Group IIB patients, but statistically significant differences was not found between these two groups in relation to glycemic control.(.(Table – 3) The study groups were analysed to find out the correlation between prolongation of VEP latencies and duration of diabetes. The P_{100} latencies were significantly prolonged in Group IIA and Group IIB patients with increased duration of diabetes. .(Table – 4). The N_{75}, N_{145} latencies and $N_{75} – P_{100}$ amplitude were not prolonged with increased duration of diabetes. .(Table – 4). A positive correlation was found between prolonged P_{100} latencies and increased duration of diabetes but, there was no statistically significant differences observed between Group IIA and Group IIB patients, in relation to duration of diabetes. (Table – 4)

Table 1: P_{100}, N_{75} and N_{145} latencies and $N_{75} – P_{100}$ amplitude in Group I, Group IIA and Group II B with HbA1c ≤ 7

VEP PARA-METERS	GROUP I HbA1c ≤ 7		GROUP II A HbA1c ≤ 7		GROUP II B HbA1c ≤ 7		P VALUE	
	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD
P100	97.9 ± 1.93	98.13± 1.59	98.37±1..81	97.97±1.88	96.25±2.86	96.42±2.78	0.075	0.57
N75	71.13±3.20	70.32±3.09	71.20±4.09	71.16 ±3.74	69.43±4.62	67.83± 3.07	0.330	0.028
N 145	135.19±3.06	133.15±6.19	136.09±5.64	134.34± 7.41	134.34±7.41	133.65±7.64	0.076	0.080
N75– P100	4.98±0.43	4.93±0.43	4.97±0.25	4.91±0.27	4.90±0.17	4.88±0.16	0.091	0.093

Table 2: COMPARING VEP RESPONSES WITH HbA1C ≤ 7 IN   GROUP IIA and   GROUP II B PATIENTS

VEP PARAMETERS	GROUP II A HbA1c ≤ 7		GROUP II B HbA1c ≤ 7		P VALUE	
	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD
P100	98.37±1..81	97.97±1.88	96.25±2.86	96.42±2.78	0.075	0.57
N75	71.20±4.09	71.16 ±3.74	69.43±4.62	67.83± 3.07	0.330	0.028
N 145	136.09±5.64	134.34± 7.41	134.34±7.41	133.65±7.64	0.076	0.080
N75– P100	4.97±0.25	4.91±0.27	4.90±0.17	4.88±0.16	0.091	0.093

Table 3 : COMPARING VEP RESPONSES WITH HbA1C ≥7 IN Group IIA and Group IIB   PATIENTS

VEP P A R A M E-TERS	GROUP II A HbA1c > 7		GROUP II B HbA1c >7		P VALUE	
	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD	RIGHT EYE MEAN ± SD	LEFT EYE MEAN ± SD
P100	107.72 ± 3.19	106.72 ± 4.04	107.21 ± 3.54	105.11 ± 4.35	0.776	0.471
N75	77.47 ± 5.12	76.34 ± 3.15	76.07 ± 8.39	77.11 ± 10.82	0.189	0.584
N 145	139.31 ± 6.1	136.91 ± .7	138.69 ± 7.5	136.57 ± 8.07	0.848	0.927
N75– P100	4.87 ± 0.3	4.91 ±0.31	5.07 ± 0.31	5.04 ± 0.29	0.224	0.428

TABLE 4: DURATION OF DIABETES AND WAVE PATTERNS OF VEP IN GROUP IIA AND GROUP IIB PATIENTS

DURATION IN YEARS	GROUP II A			GROUP II B			P VALUE		
	0 - 10	11-20	>20	0 - 10	11-20	>20	0 - 10	11-20	>20
	MEAN ± SD	MEAN ± SD	MEAN ± SD	MEAN ± SD	MEAN± SD	MEAN ± SD	MEAN ± SD	MEAN ± SD	MEAN ± SD
P100	100.21 ± 3.35	102.8 ± 2.22	107.37 ± 3.10	98.8 ± 3.64	101.46 ± 5.16	107.29 ± 5.72	0.319	0.253	0.965
N75	74.1± 5.38	76.78 ± 4.62	76.76 ± 3.93	72.36 ± 3.42	77.14 ± 7.51	75.5 ± 2.45	0.189	0.584	0..901
N 145	140.79 ± 10.43	132.79 ± 5.74	141.43 ± 5.59	141.43 ± 9.28	132.0 ± 8.83	139.25 ± 6.34	0.848	0.927	0.528
N75– P100	4.84 ± 0.46	4.95 ± 0.35	4.94 ± 0.35	5.14 ± 0.40	5.08 ± 0.22	4.87 ± 0.13	0.224	0.428	0.661

DISCUSSION

The present study was done on 40 diabetics in the age group of 30-70 years. A positive correlation was documented between glycemic control and prolonged P_{100} latencies. This findings was consistent with the observations of Samiulus[3], Pozzessere et al[5]. VEP responses were compared between Group IIA and Group IIB patients. No significant difference was found between these two groups. This finding was consistent with the observations of Pozzessere G et al[5]. Comparison of VEP responses was done between Group IIA and Group IIB in relation to glycemic control and duration of diabetes. No significant difference was found between these two groups. This findings was consistent with the observations of Algan M et al[6]. Our findings signify that there is a definite neurological deficit in diabetes mellitus. Neuropoietic cytokines including interleukin-1, interleukin-6, leukemia inhibitory factor, ciliary neuro – tropic factor (CNTF), tumour necrosis factor alpha(TNF- alpha), and transforming growth factor beta (TGF- beta), exhibit pleiotrophic effects on the homeostasis of the glia and on the neurons in the central, peripheral and the autonomic nervous systems.. With the increase in duration of diabetes, the accumulation of these mediators also increases, which can cause further delay in the latencies in diabetics with more duration of disease as compared to diabetics with a lesser duration of diabetes. P_{100} latencies were observed to be more prolonged in those who had poor glycemic control as a result of more prolonged exposure to toxic metabolites. The progressive increase in P_{100} latency values are a direct sign of retinal ganglion cell damage, which take place even before the first ophthalmoscopically detectable signs of diabetic retinopathy arise[8].

CONCLUSION

The delay in P_{100} latency was observed in diabetic patients before the development of overt retinopathy. So, VEP measurement which is highly sensitive, reliable, non invasive method for detecting the early alterations in the central optic pathways in diabetics. Intensive glycemic control will delay the development or slow the progression of optic nerve dysfunction in individuals with either type 1 or type 2 diabetes mellitus.

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Effect of Waist-Hip Ratio on Lung Volumes

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ABSTRACT

Expanding waistlines and ballooning potbellies are common sights today. Obesity lays the foundation for a host of other health issues and has the clear potential to affect respiratory well being. Hazards of 'visceral obesity' are more than that of 'subcutaneous obesity'. The aim of this study was to determine the influence of obesity on lung function by using waist-hip ratio as a measure of Central adiposity and to determine whether the effect of waist-hip ratio on lung volumes varies between males and females. This cross-sectional analytical study was done in 103 subjects recruited by convenience sampling from Thanjavur. Of these 54 were men and 49 were women. 70 had normal waist-hip ratio and 33 had high waist-hip ratio. Subjects with co-morbidities were excluded. In all these subjects pulmonary function parameters were measured following standard protocol using computerized spirometer. The present study found significant negative correlation between waist hip ratio and many parameters of pulmonary function including FEV1, FVC and PEFR. Also waist-hip ratio was found to influence pulmonary function to different extent in both the sexes. Hence subjects should be motivated to maintain ideal waist-hip ratio for better respiratory efficiency. Also further studies should be done to improve prediction equations of pulmonary function tests by taking into account the effect of body weight and distribution of body fat.

Keywords: *Lung Volumes, Obesity, Pulmonary function, Spirometry, Waist-Hip Ratio*

INTRODUCTION

Expanding waistlines and ballooning potbellies are common sights today. Obesity is fast becoming a major public health problem with severe health and economic implications, not only in developed nations, but also in developing nations. The prevalence of obesity is projected to continue to increase in the future. In India, according to a recent study in Pune, the prevalence of obesity in affluent school boys was 5-7% and that of overweight close to 20%. Obesity lays the foundation for a host of other health issues. Concept of Regional obesity was introduced in 1947 by VAGUE who was the first of point out that male pattern of obesity i.e. Central (Android) obesity was more closely associated with diabetes, gout and atherosclerosis than the female

pattern of more Peripheral (Gynaecoid) obesity[1]. Hazards of 'visceral obesity' are more than that of 'subcutaneous obesity[2]. WHR was introduced with the assumption that it would predict fat distribution better than WC alone. Presently, WHR is widely used as an index of regional adipose tissue distribution. WHR was a significant predictor of plasma triglycerides, glucose and insulin concentrations[1]. Threshold for cut-off of WHR is suggested as 0.85 for women and 0.95 for men as an index of abdominal adiposity [3].

Obesity has a clear potential to have a direct effect on respiratory well being. These complications can best be appreciated by understanding the obese person's unique respiratory physiology. Pulmonary Function Tests are being used not only by the chest physician, but also by the general physician, anaesthetist, etc. Current lung function prediction equations do not take weight into account for most of the parameters. If abdominal or upper body deposition of fat decreases diaphragmatic excursion due to increased abdominal adiposity or increased weight on the chest wall, measured lung volumes might be smaller than predicted using current

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predictive equations. Hence it is important to understand the relationship between Waist-Hip Ratio and Lung Volumes. So this study was started with the following

AIMS AND OBJECTIVES

-To determine the influence of Obesity on Lung Function by using Waist-Hip Ratio as a measure of Central Adiposity

-To determine whether the effect of Waist-Hip Ratio on lung volumes varies between obese males and females

MATERIALS AND METHOD

This cross-sectional analytical study was done in the Research laboratory, Department of Physiology, Thanjavur Medical College. Participants aged between 20 and 45 years, both men and women were recruited by convenience sampling from the general population after obtaining written informed consent. The study protocol was approved by the Institutional Ethics Committee. 103 persons participated in the study. Basic demographic information, family and medical history were obtained by interview using a questionnaire. Clinical examination was done with emphasis on chest examination. Subjects with ischaemic heart disease, diabetes mellitus , kyphoscoliosis and smokers were excluded.

Anthropometry including Waist circumference and Hip circumference were measured in erect posture using a non-elastic tape following standard measurement protocol. Values were measured to the nearest 0.1 cm at the end of quiet expiration. Waist-Hip Ratio (WHR) was calculated from the above and the study subjects were classified into two categories as shown in Table 1

TABLE 1: WHR groups

Group Name	Category	Cut-off of WHR
A	Normal WHR	< 0.85 for women < 0.95 for men
B	High WHR	> 0.85 for women > 0.95 for men

Pulmonary function tests were done using Spiro Excel-Medicaid systems 2 hours after light breakfast in sitting posture after 15 minutes of rest. Each maneuver was demonstrated to the subjects. Nose-clip was applied and subjects were instructed to breathe into the disposable mouth piece with lips sealed around it. Lung volumes, capacities and flows were evaluated through the procedures of Slow Vital Capacity [SVC], Forced Vital Capacity [FVC], and Maximum Voluntary Ventilation [MVV]. The tests were performed at least three times each, according to the standards of American Thoracic Society [ATS] and European Respiratory Society [ERS]. Best of the acceptable, reproducible recordings was selected[4]. Results were expressed as absolute values and as percentage of the predicted values. Forced Vital Capacity [FVC], Forced Expiratory Volume in one second [FEV_1], FEV_1/ FVC ratio, Peak Expiratory Flow Rate [PEFR], Forced Expiratory Flow [$FEF_{25\%}$], Expiratory Reserve Volume [ERV] and MVV were estimated.

Statistical analysis was done using SPSS Version 10. Mean and Standard Deviation were calculated for all relevant variables. Independent Student's t test was used to compare means of different variables between the High WHR and the Normal WHR groups. Pearson's correlation test was done to assess relationship between WHR and the different lung function parameters. The non-zero values of 'r' between -1 and 0 indicate negative correlation. P value < 0.05 was taken as significant. Analysis was done for the whole group and also stratified according to gender.

RESULTS

The study was conducted on 103 subjects. 70 subjects belonged to Normal WHR group and 33 subjects belonged to High WHR group. The WHR groups were stratified based on gender. The frequency distribution is shown in Table 2. Mean and Standard Deviation were calculated for all the relevant parameters. This is shown in Table 3. Table 4 shows the P value calculated for testing equality of means for the different parameters between the two groups by Independent Student's t test. P value < 0.05 was taken as statistically significant. FEV_1 % Predicted, FVC % Predicted, PEFR % Predicted , $FEF_{25\%}$ % Predicted and ERV (L) were significantly decreased in the High WHR group, when compared to the Normal WHR group   [*P value < 0.05]. Mean MVV % Predicted was higher in the High WHR group in Males, but it was lower in females. The mean MVV % Predicted was higher when calculated for the entire group without considering sex difference [*P < 0.05]. Mean FEV_1 /FVC % Predicted was higher in the High

WHR when calculated for the entire High WHR group without gender differentiation , and in males, but it was not so in females. But this difference was not statistically significant.

Table 5 shows the results of Pearson's Correlation Coefficient tests done to find the correlation between WHR and the recorded Spirometric variables. When Correlation study was done ignoring gender difference, only FEV_1 % Predicted and FVC % Predicted showed statistically significant negative correlation with WHR. In males, FEV_1 /FVC % Predicted showed statistically significant positive correlation. All the other variables did not show any significant correlation with WHR in males. But in females, all the parameters except FEV_1 /FVC % Predicted and ERV (L) showed statistically significant negative correlation [*P < 0.05].

TABLE 2. WHR Groups- Frequency distribution

Male Female			Sex		Total
Whr Groups	Normal	Count	35	35	70
		% Within Sex	64.8%	71.4%	68.0%
	High	Count	19	14	33
		% Within Sex	35.2%	28.6%	32.0%
Total		Count	54	49	103
% Within Sex			100.0%	100.0%	100.0%

TABLE 3. Mean & Standard Deviation of recorded parameters in WHR groups

WHR	Sex		FEV1 % Predicted	FVC %Predicted	FEV1/FVC %Predicted	PEFR %Predicted	FEF25% %Predicted	MVV % Predicted	ERV(L)
NORMAL	MALE	Mean	88.3286	86.7486	106.2057	96.7171	11.1229	64.9486	1.5037
		Std.Deviation	11.6846	8.8127	9.3292	15.1361	17.1175	25.7106	0.775
	FEMALE	Mean	91.4171	88.06	108.9771	94.3457	103.1971	57.1486	1.1937
		Std.Deviation	16.1446	12.7107	9.2377	20.8547	20.6956	20.8608	0.5467
	TOTAL	Mean	89.8729	87.4043	107.5914	95.5314	107.16	61.0486	1.3487
		Std.Deviation	14.0759	10.8773	9.3212	18.128	19.2708	23.571	0.6838
HIGH	MALE	Mean	87.8947	81.3158	113.8421	91.8421	103.2105	73.7421	1.2805
		Std.Deviation	12.4092	11.7665	4.9807	17.8147	19.8874	25.1148	0.7424
	FEMALE	Mean	76.8286	75.8286	107.5214	79.1214	83.9357	49.5385	1.015
		Std.Deviation	13.6515	14.1797	9.5679	18.5674	19.3064	24.4561	0.8788
	TOTAL	Mean	83.2	78.9879	111.1606	86.4455	95.0333	63.9094	1.1679
		Std.Deviation	13.8987	12.9285	7.8235	18.956	21.6213	27.2696	0.801

TABLE 4. Comparison between Normal WHR and High WHR groups as regards parameters of pulmonary function [t- test for Equality of Means between Normal WHR and High WHR groups]

	df	P value Sig(2 tailed)	Mean Difference	Std.Error Difference	95 % Confidence Interval of the Difference	
					Lower	Upper
FEV₁ % Predicted	72	< 0.0005*	12.9396	3.4704	6.0215	19.8578
FVC % Predicted	72	< 0.0005*	13.5823	2.8487	7.9036	19.261
FEV₁ /FVC % Predicted	72	0.388	-1.9921	2.2929	-6.563	2.5788
PEFR % Predicted	72	< 0.0005*	18.446	4.2221	10.0293	26.8626
FEF₂₅% % Predicted	72	< 0.0005*	23.0531	4.5982	13.8869	32.2193
MVV % Predicted	72	< 0.0005*	23.4009	5.1484	13.1353	33.6665
ERV (L)	72	0.023*	0.384	0.165	5.508E-02	0.7129

*P value < 0.05 was taken as statistically significant.

TABLE 5. Correlation between WHR and the parameters of pulmonary function

	WHR (Correlation-Whole group)		WHR(Correlation-Males)		WHR(Correlation-Females)	
	Pearson Cor-relation	P value -Sig.(2 Tailed)	Pearson Cor-relation	P value -Sig.(2 Tailed)	Pearson Cor-relation	P value -Sig.(2 Tailed)
FEV_1 % Pre-dicted	-0.211	0.032*	-0.022	0.872	-0.486	< 0.0005*
FVC % Pre-dicted	-0.288	0.003*	-0.223	0.105	-0.495	< 0.0005*
FEV_1/FVC % Predicted	0.088	0.375	0.329	0.015*	-0.099	0.5
PEFR % Pre-dicted	-0.157	0.113	-0.161	0.244	-0.431	0.002*
$FEF_{25\%}$ % Pre-dicted	-0.127	0.203	-0.218	0.113	-0.53	< 0.0005*
MVV % Pre-dicted	0.05	0.619	0.056	0.687	-0.411	0.004*
ERV (L)	-0.054	0.587	-0.213	0.122	-0.276	0.055

*P value < 0.05 was taken as statistically significant.

DISCUSSION

Even uncomplicated simple obesity exerts effects on pulmonary gas exchange, oxygenation of the blood, and the work of breathing and it has modest effects on ventilatory drive and the pattern of breathing. Obese patients often complain of exercise intolerance and dyspnoea during exertion. Additional fat in the abdomen raises the diaphragm and this reduces the FRC and ERV. The lung bases are therefore poorly ventilated which contributes to hypoxemia[5]. Obesity increases the pressure placed on the chest wall and thoracic cage, which restricts pulmonary function by decreasing respiratory compliance, increasing the work of breathing, restricting ventilation [measured as decreased total lung capacity, forced vital capacity and MVV] and limiting ventilation of lung bases. There may be up to a threefold increase in elastic resistance to respiratory distension in severely obese individuals. This largely results from reduced distensibility of extra pulmonary structures from excess truncal fat.

Differential fat distribution among males and female tends to affect the pulmonary functions[6]. Some studies but not all studies suggest that the effect of obesity on absolute lung function may be greater among men than among women probably attributable to greater central fat distribution in men[7]. Preliminary studies of severely obese persons with upper body obesity suggest that they have more severely compromised lung volumes than those with lower body obesity[8]. It has been suggested that WHR, rather than BMI, explains a large part of the variance in pulmonary gas exchange.

The effects of various patterns of obesity on pulmonary function have been studied in the present study in both the genders. FEV_1 and FVC were significantly decreased in the High WHR group, when compared to the Normal WHR group [P value < 0.05] in this study. This may be due to mechanical limitation of chest expansion as accumulation of excess fat interferes with the movement of the chest wall and the descent of the diaphragm. Canoy et al[9] analysed the association of WHR and pulmonary function in the European Prospective Investigation into Cancer and Nutrition study [EPIC study], and reported an inverse association of WHR with FVC and FEV_1. In men, compared to BMI, WHR showed more significant inverse association in their study. Harik Khan et al [10] have evaluated the association of WHR with lung volumes and have found significant negative association of WHR with FEV_1 only in men. Ross Lazarus and associates[11] did not find inverse association of WHR with FVC in women. This is in contrast to the present study result. Leone et al[12] have demonstrated that even mild abdominal obesity, even with a normal BMI, is associated with lower VC and FEV_1 in men and women. Collins et al[8] have found

significantly lower FVC and FEV_1 in subjects with WHR of 0.950 or greater [upper body fat distribution] which is similar to the present work. Chen et al [13] also have shown significant negative association of WHR with FVC and FEV_1 in a cross-sectional study of 1674 adults. This relationship was seen in both males and females in their study. In the present study, statistical analysis showed negative correlation of WHR with FEV_1 and FVC in both the sexes. But the association was found to be statistically significant only in females. Mean FEV_1/FVC Ratio was higher in the High WHR when calculated for the entire High WHR group without gender differentiation , and also in males, but it was not so in females. But this difference was not statistically significant.

In this study PEFR was lower in the High WHR group, but the decrease significantly correlated with WHR only in females. Sri Nageswari et al [14] have showed significant decrease in PEFR in obese individuals in their study. $FEF_{25\%}$ showed significant negative correlation with WHR only in females in our study. Farida et al [15] have shown similar decrease in $FEF_{25\%}$ in obese persons in their study. The High WHR group showed higher mean value of MVV in males but the rise was not significant. But females showed significant negative correlation of WHR with MVV. Sahebjami and associates [16] studied 63 obese males without significant airway obstruction and they found low MVV in 42 of the subjects. In our study the High WHR group had significant reduction in ERV when compared to the Normal WHR group. Both males and females showed negative correlation of ERV with BMI and WHR, but the correlation was not significant when gender stratification was done.

CONCLUSION

The present study found significant negative correlation between Waist-Hip Ratio and many parameters of Pulmonary Function. This strengthens the hypothesis of the study that Waist-Hip Ratio influences lung volumes. It also shows that abdominal adiposity per se can influence pulmonary function by various mechanisms. All the above changes were seen in clinically normal subjects without co-morbidities other than high Waist-Hip Ratio. It was also found that WHR influences pulmonary function to different extents in both the sexes. Hence the routine measurement of WHR will help the interpreting physician to take into account the effect of central adiposity on lung volumes. Also

obese subjects, especially those with central adiposity can be motivated to achieve ideal body weight since the present study has strengthened the hypothesis that central adiposity impairs lung function.

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Influence of Diabetes Duration on Cardiac Autonomic Neuropathy in Diabetic Patients

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ABSTRACT

Background: Cardiovascular autonomic neuropathy (CAN) encompasses damage to the autonomic nerve fibers that innervate the heart and blood vessels, resulting in abnormalities in heart rate control and vascular dynamics. Diabetic autonomic neuropathy (DAN) is one of the common complications of diabetes. Autonomic dysfunction can affect daily activities of individuals with diabetes and may invoke potentially life-threatening outcomes. Years of research and clinical testing, now make it possible to objectively identify early stages of CAN with the use of careful measurement of autonomic function and to provide therapeutic choices that are based on symptom control and that might do away with the underlying disorder.

Objectives: This study analyzed the cardiac autonomic function in type 2 diabetes mellitus (DM) patients to know the relation between duration of diabetes and autonomic function.

Material and Method: A cross sectional study was carried out on 100 diagnosed type-2 DM patients from the rural population of Sullia who attended KVG medical college OPD; they were nonsmokers and did not suffer from any cardiopulmonary disease. They were divided in two groups based on disease duration, Group-A had 50 subjects with diabetes for <5 years and Group-B consisted of 50 subjects with >5 years of disease. Cold pressor test and standing test, were done and the findings of two groups were compared. Statistical analysis was done using unpaired t test.

Results: Basal heart rate and blood pressure were higher in the diabetic group than control group (p<0.05). With increased duration of diabetes there was no significant reduction in autonomic function parameters.

Conclusion: Evaluation of cardiovascular reflexes in type 2 DM subjects with paucity of related symptoms constitutes an important feasible and reproducible bedside clinical technique. No significant changes were observed in the autonomic parameters with increased duration of diabetes.

Keyword: Type 2 Diabetes Mellitus, Cold Pressor Test, Standing Test, Autonomic Function.

INTRODUCTION

The term diabetes mellitus describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion and or insulin action.[1] Diabetes mellitus is a leading public health care problem in developing and developed world, with increasing incidence and long-term complications.

Type 2 diabetes mellitus (T2DM) exerts a huge toll in human suffering and economy. It has been estimated that the global burden of T2DM for 2011 was 366 million people which is projected to increase to 552 million in 2030.[2] Similarly, for India this increase is estimated to be 58%, from 51 million people in 2010 to 87 million in 2030.[3]

Diabetic neuropathy is one of the common complications of diabetes and specifically autonomic

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neuropathy can affect several systems with clinical manifestations of dysautonomy being more common in the cardiovascular, genitourinary, gastrointestinal, and thermoregulatory systems.[4] Diabetic autonomic neuropathy (DAN) frequently coexists with other peripheral neuropathies and other diabetic complications, but DAN may be isolated, frequently preceding the detection of other complications. Despite its relationship to an increased risk of cardiovascular mortality and its association with multiple symptoms and impairments, the significance of DAN has not been fully appreciated.[5]

Neuropathy – especially autonomic neuropathy – is the most common complication of diabetes which is not investigated so frequently. One of the earliest manifestations of diabetic autonomic neuropathy is denervation of the cardiovascular system.[6] Hence assessment of cardiovascular reflexes affords a satisfactory evaluation. The prevalence of autonomic nervous system dysfunction in diabetes is not precisely known; however, tests of autonomic function have shown impairment in nearly 20 - 30% of diabetic patients.[7] Presence of symptoms along with abnormal cardiovascular function tests suggest poor prognosis and increased incidence of silent myocardial infarction, cardiac arrest, sudden death, and inadequate response to stressful events, e.g., anesthesia and surgery.[8]

OBJECTIVE

This study analyzed the cardiac autonomic function in type 2 diabetic patients to know the relation between duration of diabetes and autonomic function.

MATERIAL AND METHOD

This cross sectional study was carried out in the Research laboratory, Department of Physiology, KVG Medical College and Hospital, Sullia on 100 diagnosed type 2 diabetes subjects attending the OPD. They were divided in two groups based on disease duration, Group-A had 50 subjects with diabetes for <5 years and Group-B consisted of 50 subjects with >5 years of disease.

Subjects up to the age of 60 years who provided informed written consent were interviewed and a detailed clinical history was taken, using a structured questionnaire to conduct the various examinations. Those subjects who had any cardiopulmonary illness or were smokers or chronic drug abusers and subjects with neuromuscular disease or malignancy were excluded from the study.

Examination performa used for recording history and clinical examination findings was designed and validated. Electrocardiograph machine (UNI-EM Cardiomin) was used for Standing test (30:15 RR ratios). Cold pressure test was carried out using ice cold water, sphygmomanometer and stethoscope.

Technique of Cold pressor test

For this test the subjects pulse rate and blood pressure is measured first. Then the subjects hand is immersed in cold water, maintained at 4±0.5ºC and it is kept immersed up to the distal palmar crease for a duration of 2 minutes.[9,10] The subject is asked to relax, breathe quietly and avoid valsalva-like maneuver during the immersion.

Blood pressure is measured using mercury sphygmomanometer on the opposite arm at thirty seconds, ninety seconds and 2 minutes during the immersion and one, two, and five minutes during post immersion period.

Technique of Standing test (30:15 RR ratio) [11,12]

The subject was asked to relax in prone position for 5 min and then, unassisted, to stand up in a period of 10 s, and an ECG was registered for a further 60 s. The 30:15 ratios were calculated as the ratio between the longest R–R interval at or around the 30th beat and shortest R–R interval at or around the 15th beat after standing up from lying down position.

STATISTICAL ANALYSIS

Student independent 't' test has been carried out to test the significance of mean. One Way ANOVA (Bonferroni) has been used to compare the significance of means between the two groups. SPSS 20 was used for analysis of data.

RESULTS

Table-1: Age and gender distribution of study subjects

Diabetes duration	N	Age (Yrs)		Sex	
		Range	Mean ± SD	Male	Female
< 5 yrs	50	44-60	52.60 ± 3.9	30	20
> 5 yrs	50	43-60	52.52 ± 3.8	30	20
Significance	**p**	> 0.05, NS		>0.05, NS	

All values are expressed as Mean ± SD

Analysis of all parameters done by Independent T- test

HS-Highly significant, S- Significant, NS-Not significant

The diabetes group was divided according to duration of disease into two groups of <5 years diabetes which had 50 cases (34%) and >5 years diabetes which had 50 cases (66%).

Table-2: Physical characteristics of study subjects

Diabetes duration	Height (meters)		Weight (Kgs)		BMI (kg/m^2)	
	Range	**Mean ± SD**	**Range**	**Mean ± SD**	**Range**	**Mean± SD**
< 5 yrs	1.57 –1.80	1.73 ± 0.05	52 - 98	66.76 ± 11.11	17.36 – 1.28	22.32 ± 3.33
> 5 yrs	1.55 –1.83	1.71 ± 0.07	45-110	66.12 ± 11.71	16.92 – 31.1	22.38 ± 3.21
Significance p	> 0.05, NS		> 0.05, NS		> 0.05, NS	

Analysis of parameters done by Independent T- test

HS-Highly significant, S- Significant, NS-Not significant

On analyzing the physical characteristics of the two groups there was no significant difference in their height, weight and BMI.

Table-3: Comparison of cold pressor test parameters with relation to duration of T2DM

	Mean SBP		Significance	Mean DBP		Significance
	Diabetes		**p**	**Diabetes**		**P**
	< 5 yrs	> 5 yrs		< 5 yrs	> 5 yrs	
Baseline	105.76±10.36	104.61±12.71	>0.05, NS	62.47±5.77	65.58±7.28	>0.05, NS
Ice Immersion						
30 sec	107.65±10.66	105.51±12.39	>0.05, NS	64.23±5.47	66.85±6.86	>0.05, NS
90 sec	108±10.82	107.21±11.32	>0.05, NS	64.82±5.83	67.58±7.07	>0.05, NS
2 min	108.82±9.08	108.61±10.75	>0.05, NS	65.76±5.83	68.61±7.11	>0.05, NS
Post immersion						
1min	104.47±10.09	102.79±14.51	>0.05, NS	62.23±5.43	65.21±6.38	>0.05, NS
2min	105.18±9.64	104.06±11.89	>0.05, NS	62.35±5.3	64.91±6.60	>0.05, NS
5min	105.18±9.11	103.70±11.07	>0.05, NS	62.23±5.91	65.58±7.28	>0.05, NS

All values are expressed as Mean ± SD
NS-Not significant

A fall in systolic blood pressure and an increase in diastolic blood pressure was observed in cold pressor test parameters in the two study groups but the difference was insignificant with p value >0.5.

Table-4: Comparison of Standing test 30:15 RR ratio parameters with relation to duration of T2DM

	Duration (yrs)		Significance P
	< 5	> 5	
30:15 RR ratio	0.98±0.05	0.98±0.04	>0.05, NS

All values are expressed as Mean ± SD
NS-Not significant

No significant difference was observed in 30:15 RR ratio in the two study groups.

DISCUSSION

The present study of evaluation of changes in autonomic functions based on duration of diabetes was carried out with the study group involving 50 type 2 diabetes patients < 5 year and 50 type 2 diabetes patients with > 5 years disease. All subjects were within the age group of 44 to 60 years.

Immersion of hand in cold water produces a marked increase in HR, SBP and DBP. These changes can be explained on the basis of increased sympathetic activity with release of nor epinephrine and epinephrine. In type 2 diabetes subjects, increase in these parameters is seen to be blunted. [13]

The variation of blood pressure (both systolic and diastolic) during cold pressor test, shows no significant change with relation to duration of diabetes (Table 3) in the present study. This is not in agreement with other studies like that done by Mohan et al[14] and Ratzmann et al.[15] which showed increase in prevalence of CAN with duration of diabetes.

In healthy subjects, there is a characteristic and rapid increase in heart rate in response to standing that is maximal at approximately the 15th beat after standing. This is followed by a relative bradycardia that is maximal at approximately the 30th beat after standing. In patients with diabetes and autonomic neuropathy, there is only

a gradual increase in heart rate. This measure, called the 30:15 ratio, reflects the overall condition of the parasympathetic fibers.[8]

It was also seen in the present study that no significant difference was observed based on duration of diabetes (Table 4).

A possible explanation of these findings can be that diabetes was probably present in the recently diagnosed patients since long but was not detected and so the disease was present for longer period than what was apparent.

CONCLUSION

Evaluation of cardiovascular reflexes in type 2 DM subjects with paucity of related symptoms constitutes an important bedside clinical tests which should be included in the work-up of type-2 diabetes patients as it often uncovers autonomic neuropathy even in the asymptomatic state. It is also a pointer to embark upon a search for other complications of diabetes often associated with it.

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Cardiac Autonomic Neuropathy in Women During Menopausal Transition Period and its Association with Psychological Stress Levels: An Observational Study

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ABSTRACT

Context: Perimenopause is a transitional stage which occurs before menopause in which women experience myriad symptoms like hot flushes, anxiety & depression with increasing, psychological stress levels leading to autonomic dysfunction.

Purpose: Evaluate cardiac autonomic neuropathy (CAN) in women during menopausal transition period and its association with psychological stress levels.

Methodology: Study includes three groups of women, group I: premenopausal in the age group of 25-40 years, group II: perimenopausal women without symptoms and group III: perimenopausal women with symptoms in the age group of 40-50 years of 30 in each (total n=90). CAN was evaluated in terms of presence of resting tachycardia, loss of sinus arrhythmia (DBD) and heart rate response to Valsalva maneuver (VR) by electrocardiogram (ECG). If any two of them found positive, then presence of CAN was confirmed. Psychological stress levels were evaluated using standard women's health questionnaire. Correlation between Psychological stress levels with incidence of CAN was assessed.

Results: There exists a statistically significant positive correlation between DBD and VR with anxiety depressed mood, well being, vasomotor symptoms, somatic symptoms, and memory. (p=0.000**)

Conclusion: This study indicates that CAN have a strong association with psychological stress levels in perimenopausal women.

Keywords: Perimenopausal, Autonomic functions, Valsalva ratio, Sinus arrhythmia

INTRODUCTION

The reproductive period of women, gradually transcends into stage of perimenopause, followed by menopause after couple of years.[1] Perimenopause is a transitional stage which is before menopause which can range from 2 to 10 years. In this stage, menstrual periods are irregular, with 30% decrease in estrogen and progesterone.[1]

Vasomotor symptoms (VMS) such as hot flushes and night sweats are main physical signs that occur in 50-70% of women during menopausal transition period.[2] In addition, women also experience symptoms like anxiety, mood changes, cognitive deficits and somatic symptoms (SOM).[3]

The changes in hormonal status during this period, mainly estrogen has potent influence on vital organ systems.[2] Along with cardiovascular risk, reduction in estrogen level also causes climacteric symptoms like vasomotor, psychological or musculoskeletal disturbances that may contribute to stress among

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women during this period.[4] Psychological stress itself is an individual risk factor for cardiovascular disease (CVD).[5] Symptoms of menopausal transition may be attributed to reduction in beneficial effects of estrogen.[6] Common clinical characteristics of transition are change in women's usually regular menstrual periods and beginning of vasomotor symptoms. These symptoms suggest alteration of either cardiovascular reflexes or local control of blood flow to skin, i.e. alteration of autonomic hemodynamic control.[7] The high incidence of ischemic heart disease after menopause suggests close association between ovarian hormone levels and cardiovascular system.[8]

Autonomic control of heart plays an important role in cardiac mortality which maintains homeostasis in our body. Alteration in autonomic nerve function may lead to hypertension, cardiac arrhythmia, increased incidence of silent Myocardial infarction or sudden cardiac death.[9,10] Few studies are conducted to assess the incidence of cardiac autonomic neuropathy in peri menopausal as compared to post-menopausal women. Studies showed that in both peri and post-menopausal women, variations in hot flash frequency and severity were not explained by variations in resting sympathetic activation.[11] Study done by Shivwani showed significant increase in sympathetic reactivity in perimenopausal and postmenopausal women- presumably as hormone levels fall with onset of perimenopause. However, parasympathetic functions showed statistically insignificant change.[7] There are no studies which shows incidence of cardiac autonomic neuropathy in peri menopausal women in association with psychological stress levels, so following study was conducted.

MATERIALS AND METHOD

It is cross sectional study conducted in department of Physiology, SDM medical college and hospital during April-August 2017 after obtaining institutional ethical clearance. The study includes 3 groups. Group I were pre-menopausal women (n=30) of age 25-40 years having regular menstrual cycle once in every 28-30 days in follicular phase (7-14 days). Group II were peri-menopausal women without any symptoms (n=30) of the age 40-50 years. Group III were peri-menopausal women (n=30) of age 40-50 years, with symptoms like Changing periods- length of cycle, hot flushes, night sweats, etc. Sample size was decided based on previous research references. Volunteers were recruited from

staff community and general population after explaining the procedure in detail and obtaining written informed consent.

Exclusion criteria- Pregnant females, with any kind of metabolic disorder like diabetes mellitus, hypertension, irregular menses, any ovarian disorders, amenorrhea for consecutive 12months, any endometrial disorders.

Study design: Subjects were instructed not to have coffee, tea or cola 12 hours before tests. They were asked to come to physiology laboratory at 9 am after having light breakfast. Detailed history was taken on standard proforma regarding history of any peri menopausal symptoms. A written informed consent was taken before conducting study in English and local languages. Subjects were assured that report will be kept confidential and used only for study.

Parameters assessed were cardiac autonomic function test and psychological stress levels. Presence or absence of CAN was determined by performing following 3 different tests.

1. Resting tachycardia

2. Loss of sinus arrhythmia

3. Heart rate response to Valsalva maneuver

If any two tests were positive then presence of CAN was confirmed.

Instrument– ECG instrument with paper speed of 25 mm/sec was used for all tests (BPL, CARDIART 6208 VIEW. BPL LIMITED, BANNERGHATTA ROAD, BANGALORE).

PROCEDURE

1. Resting tachycardia: The subjects were asked to relax in supine position for 30 minutes. Resting heart rate was calculated for evaluation of resting tachycardia and recorded on standard ECG from lead II. Values of >100 beats/minute were considered abnormal.

2. Loss of sinus arrhythmia: Heart rate variation with respiration was observed for loss of sinus arrhythmia. In sitting position, subjects were asked to take 6 deep breaths/minute. A continuous ECG was recorded for six cycles. The maximum and minimum R-R intervals were measured during each breathing cycle and converted

into beats/minute. The results were expressed as mean of difference between maximum and minimum heart rate for six measured cycles. Normal response is difference of ≥15 beats/minute, while 10-15 beats and <10 beats/minute were taken as borderline and definitive CAN respectively.[12]

3. Heart rate response to Valsava maneuver: In sitting position person was asked to blow into a mouthpiece connected to mercury manometer and holding it at 40 mmHg for 15 seconds, simultaneously monitored by ECG. The ECG continued to be recorded even 15 seconds after release of pressure. The heart rate changes induced by Valsalva maneuver were expressed as ratio of maximal tachycardia during maneuver to maximal bradycardia after maneuver. This ratio was defined as Valsalva ratio and calculated as ratio of longest R-R interval to shortest R-R interval. Normal Valsalva ratio is ≥1.2; values ≤1 were taken as evidence of CAN. Values of 1-1.2 were taken as borderline.[12]

Assessment of menopause-associated symptoms was performed using Women's Health Questionnaire (WHQ).[6] The WHQ is 23-item self-reported health-related quality of life scale that was designed to assess wide range of physical and emotional symptoms, experienced by middle aged women. There were four response options for each item, ranging from 1-4, where 1 means "yes definitely" and 4 means "not at all." This provides scores on six factors: Anxiety depressed mood, well-being, Somatic symptoms, memory and concentration, vasomotor symptoms, and sleep problems. Raw scores were calculated for each scale. Transformed scores were obtained from raw scores. Scores vary from 0, which indicates "poor health status" to 100 which indicates "good health status."

STATISTICAL ANALYSIS

Statistical analysis was done by using SPSS software version-20. Values were expressed as mean±SD. Intergroup and intragroup analysis was done by ANOVA and tukey's post hoc analysis. P values <0.05 was considered significant & <0.01 as highly significant. A Pearson's correlation was used to see relationship between psychological stress levels with cardiac autonomic function parameters.

RESULTS

It is cross sectional study done to assess CAN in women during menopausal transition period and its association with psychological stress levels.

Table-1 shows cardiac autonomic function tests values amongst three groups. RHR increases in perimenopausal women with symptoms when compared to premenopausal and perimenopausal women without symptoms but not statistically significant. There is significant reduction in deep breathing difference in perimenopausal women with & without symptoms when compared to premenopausal women (p=0.00**). There is statistically significant reduction in Valsalva ratio in all three groups (p=0.00**).

Table-2 shows psychological stress levels assessed by six domains of women's health questionnaire. There is significant reduction in scores of anxiety depressed mood, well-being and vasomotor symptoms in perimenopausal women with symptoms when compared to premenopausal and perimenopausal women without symptoms (p=0.00**). There is also reduction in scores of somatic symptoms, sleep and memory in perimenopausal women with symptoms when compared to premenopausal and perimenopausal women without symptoms but not statistically significant.

Table-3 shows correlation between RHR with domains to assess psychological stress levels. There is statistically significant negative correlation between RHR with scores of anxiety depressed mood, well being and vasomotor symptoms.

Table-4 shows correlation between DBD with domains to assess psychological stress levels. There is significant positive correlation between DBD with scores of anxiety depressed mood, well being, vasomotor symptoms, somatic symptoms, and memory.

Table-5 shows correlation between VR with domains to assess psychological stress levels. There is significant positive correlation between VR with scores of anxiety depressed mood, well being, vasomotor symptoms, somatic symptoms, and memory.

Table 1: Cardiac autonomic values amongst pre and peri menopausal women.

Cardiac function tests	Group I	Group II	Group III	F value	P value	Post- hoc analysis (p value)
Resting heart rate (beats/min)	73.46±8.33	75.63±7.95	77.90±9.08	2.055	0.134	I Vs II 0.585 I Vs III 0.112 II Vs III 0.556
Deep breathing difference(beats/min)	24.86±5.53	18.43±5.29	16.30±4.05	23.842	0.00**	I Vs II 0.00** I Vs III 0.00** II Vs III 0.230
Valsalva ratio	1.31±.08	1.24±.09	1.13±.09	29.119	0.00**	I Vs II .009** I Vs III 0.00** II Vs III 0.006**

Table 2: Psychological stress levels using women health questionnaire amongst pre and peri menopausal women.

Parameter (transformed scores)	Group I	Group II	Group III	F value	P value	Post hoc analysis p value
Anxiety depressed mood	74.40±3.10	72.63±4.49	54.30±3.83	250.150	.00 **	I Vs II 0.184 I Vs III .00** II Vs III .00**
Well being	72.80±3.71	72.80±5.21	54.46±3.86	180.163	.00**	I Vs II 1.000 I Vs III .000** II Vs III .000**
Somatic symptoms	71.66±2.74	70.00±4.33	69.36±8.15	1.370	.260	I Vs II .480 I Vs III .250 II Vs III .898
Vasomotor symptoms	71.80±3.13	70.46±4.55	54.03±5.16	153.836	.000**	I Vs II 0.467 I Vs III .000** II Vs III .000**
Memory	71.93±3.43	69.66±4.91	70.36±6.42	1.568	.214	I Vs II .200 I Vs III .459 II Vs III .855
Sleep	72.53±3.55	70.63±6.81	70.66±6.97	.988	.377	I Vs II 0.56 I Vs III 0.53 II Vs III 0.44

Group I: pre- menopausal Women, Group II: Peri menopausal women without symptoms,

Group III: Peri menopausal women with symptoms .Values are expressed as mean ± SD. p< 0.05 * is significant. p<0.01** highly significant.

Table 3: Shows correlation of resting heart rate (RHR) with domains assessing psychological stress levels (n=90).

	Anxiety depressed mood	Well being	Somatic symptoms	Vasomotor symptoms	Memory	Sleep
RHR (Beats/min)	r= -.249 p= .018*	r= -.228* p= .031*	r= -.052 p= .629	r= -.240 p= .023*	r= -.008 p= .940	r= -.169 p= .111

r =- (negative correlation): r = + (positive correlation), p <0.05 is significant, p < 0.01 is highly significant.

Table 4: Shows correlation of deep breathing difference (DBD) with domains assessing psychological stress levels (n=90).

	Anxiety depressed mood	Well being	Somatic symptoms	Vasomotor symptoms	Memory	Sleep
DBD (Beats/min)	r= +0.406 p=0.00**	r= +0.375 p= 0.00**	r=+0 .267 p= .011*	r=+0 .435 p= .00**	r=+0 .328 p= .002**	r=+0 .117 p= .272

r=- (negative correlation): r= + (positive correlation),p <0.05 is significant, p < 0.01 is highly significant.

Table 5: Shows correlation of valsalva ratio (VR) with domains assessing psychological stress levels (n=90).

	Anxiety depressed mood	Well being	Somatic symptoms	Vasomotor symptoms	Memory	Sleep
VR	r= +0.406 p=0.00**	r= +0.375 p= 0.00**	r=+0 .267 p= .011*	r=+0 .435 p= .00**	r=+0 .328 p= .002**	r=+0 .117 p= .272

r=- (negative correlation): r= + (positive correlation), p <0.05 is significant, p < 0.01 is highly significant.

DISCUSSION

Results shows deep breathing difference is significantly reduced in perimenopausal women with symptoms when compared to premenopausal women and not significantly reduced when compared to perimenopausal women without symptoms [F (2, 87) =23.842, p=0.000]. Valsalva ratio was significantly reduced in perimenopausal women when compared to pre- and peri-menopausal women without symptoms [F (2, 87) = 29.119, p=0.000]. Results of our study are similar to work done by Shivwani et.al which showed autonomic reactivity in pre, peri and post-menopausal women. There was decrease in Valsalva ratio and tachycardia ratio in peri and postmenopausal women in comparison to premenopausal women; although difference was not statistically significant.[7] Gibson CJ studied Cardiac autonomic function and hot flashes among perimenopausal and postmenopausal women

which showed strong association between hot flushes and parasympathetic component.[11] Perimenopausal women also showed increase in sympathetic activity which was consistent with findings of Kumar et.al with an increase in total body nor-epinephrine spillover. There was decrease in the nor-epinephrine-induced vasoconstriction after estrogen supplementation.[13]

Mercuro et.al also showed that surgical menopause induces a decline in cardiac vagal modulation with a shift towards sympathetic hyperactivity.[14] Du et.al have also shown that cardiovascular protection by estrogen is partly mediated through modulation of autonomic nervous system.[15]

There are several mechanisms through which reproductive hormonal status may influence cardiovascular autonomic reactivity. These include altering receptor sensitivity, density or neurotransmitter availability. The role of estrogen on cardiac autonomic

modulation action can be explained by its effect on enhancing the cholinergic muscarinic activity in central nervous system and such modulation at central and peripheral levels tends to suppress sympathetic but elevate parasympathetic tone.[16]

Our study also shows that all six domains assessing women's health questionnaire are significantly reduced in perimenopausal women with symptoms when compared to premenopausal women which signifies poor health status. Results of our study is consistent with findings of Ashwini and collegues which showed that symptoms of menopausal transition are attributed to reduction in estrogen level which lead to substantial psychological stress among women during peri menopausal transition period.[6] Our study also shows positive correlation between deep breathing difference and Valsalva ratio with the psychological stress levels assessed by women's health questionnaire. It demonstrates association between stress levels and autonomic functions in perimenopausal women. The basic cause of symptoms of menopausal transition is complex relationship with estrogen metabolism and autonomic nervous system which is confirmed by Lee et al. Increased sympathetic activity may be a link between reduction in estrogen and psychological stress during menopausal transition period.[17]

CONCLUSION

Our study shows that women during menopausal transition period are prone for elevated psychological stress level which has association with cardiac autonomic dysfunction and increases the incidence of cardiac autonomic neuropathy.

Conflict of Interest: None

Source(s) of Funding: Self

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Autonomic Nervous System Activity in Migraine Patients

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ABSTRACT

Background: Headache is among the most common reasons patients seek medical attention. In literature autonomic nervous system (ANS) impairment in migraine is well documented i.e. migraine is of neural origin. Different symptoms of migraine attacks such as nausea, vomiting, diarrhea, pallor, flushing, piloerection and diaphoresis are explained with the instabilities of ANS. Enhanced understanding of the ANS dysfunction in migraine may help to more effectively diagnose, prevent &/or treat migraine.

Materials and Method: Thirty migraine female patients aged 25 to 55 were included. Thirty age and gender matched controls were chosen for comparison.Two non-invasive parasympathetic tests and two non-invasive sympathetic tests were performed. Statistical analysis was done by unpaired student't' test.

Results: Parasympathetic tests showed significantly decreased heart rate variation during deep breathing and immediate standing in migraineurs when compared to controls (P<0.05). Sympathetic tests did not show significant difference.

Conclusion: Parasympathetic hypofunction was suggested in our study.

Keywords: migraine; autonomic function tests

INTRODUCTION

Migraine, the second most common cause of headache, afflicts approximately 15% of women and 6% of men over a one year period.[1] Migraines have a multifactorial etiology, and dysautonomia has been suggested as a main etiologic factor.[2]

Autonomic symptoms which frequently occur in migraine include nausea, vomiting, photophobia, phonophobia, abnormal pupillary reaction, diarrhea, cutaneous vasoconstriction (pallor), vasodilatation (flushing), piloerection and diaphoresis.[3]

It has been proposed that both sympathetic and parasympathetic dysfunctions have played important roles in the pathophysiology of migraine.[4]

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MATERIALS AND METHOD

In this study data was collected from thirty migraine female patients diagnosed according to Headache Classification Committee of the International Headache Society 2004,[5] in the age group of 25 to 55 years, attending Neurology OPD. Thirty age and gender matched controls were selected.

i) Inclusion criteria:

Subjects aged between 25 and 55 years, who report of headache lasting 4 to 72 hours with normal physical examination and are diagnosed as having migraine by a Neurophysician along with at least two of the following features:

1. Unilateral pain

2 Throbbing pain

3 Aggravated by movement

4 Moderate or severe intensity

Plus at least one of the following features:

1. Nausea/ vomiting

2. Photophobia and phonophobia

(Adapted from the Headache Classification Committee of International Headache Society, 2004)[5]

ii) Exclusion criteria:

1. Upper respiratory tract infections

2. Meningitis

3. Intracranial hemorrhage

4. Intracranial tumors

5. Temporal arteritis

6. Glaucoma

7. Any condition associated with ANS dysfunction like Diabetic neuropathy, familial dysautonomias, drugs affecting ANS (beta blockers etc), and tobacco abuse either smoking or chewing.

Physical anthropological indices like Height (cm), Weight (Kg), BMI. General and systemic examination of the patients was done and the findings were recorded. The resting heart rate and blood pressure were recorded in each participant under resting conditions.

Autonomic function tests:

In the present study four cardiovascular autonomic function tests were performed, two tests evaluating the parasympathetic division and two tests evaluating sympathetic division. The instruments required are Electrocardiograph, Sphygmomanometer and hand grip dynamometer.

Procedure:

The subject was asked to lie down on a couch comfortably and completely relaxed.

Recording mode was put under manual mode. A standard chemical coated electrocardiograph recording paper of 50mm × 20 meters was used for recording the ECG.

Methods of assessment of cardiovascular autonomic function tests:

The following cardiovascular autonomic function tests were performed as per Ewing and Clarke guidelines. The first two of the tests reflect cardiac parasympathetic integrity, while the other two reflect sympathetic integrity

Parasympathetic function tests:

1) Heart rate variation during deep breathing: (Expiration: Inspiration ratio)

The subject in lying down position was asked to breathe quietly and deeply at a rate of six breaths per minute (five seconds in and five seconds out for every breath). An E.C.G was recorded throughout the period of deep breathing. The maximum and minimum R-R intervals were noted during expiration and inspiration respectively and the ratio of longest R-R interval during expiration to shortest R-R interval during inspiration was calculated. A ratio of ≥ 1.2 is considered normal.

2) Immediate heart rate response to standing: (30:15 ratio)

The test was performed with the subject lying quietly on a couch for about 5 minutes while a heart rate is recorded continuously on a E.C.G .The subject is then asked to stand up unaided, the point at starting to stand was marked on electrocardiograph. The shortest R-R interval at or around the 15th beat and the longest R-R interval at around the 30th beat after starting to stand were noted. The characteristic heart rate response is expressed by the 30:15 ratio calculated from the following formula:-

30: 15 ratio = The longest R-R interval at or around the 30th beat

The shortest R-R interval at or around the 15th beat

30: 15 ratio of

a) 1.01 to 1.03 was considered as borderline

b) 1 or less was considered as abnormal response.

Sympathetic function tests

1) Blood pressure response to standing:

The test was performed by measuring the subject's blood pressure with a sphygmomanometer while he is lying down quietly and again when he stands up. The postural fall in blood pressure was taken as the difference between the systolic blood pressure lying and

the systolic blood pressure standing.

A postural fall of systolic pressure of

a) 10 mm Hg or less was considered normal

b) 11 to 29 mm Hg was considered borderline

c) 30 mm Hg or more was considered as abnormal response.

This simple test gives an abnormal result only with severe peripheral Sympathetic damage.

2) Blood pressure response to sustained handgrip:

The maximum voluntary contraction was first determined using a handgrip dynamometer. The subject was then asked to maintain the handgrip (isometric contraction) of 30 % of that maximum as long as possible for 3 minutes. Blood pressure was measured before and at one-minute intervals during handgrip. The result is expressed as the difference between the highest diastolic blood pressure during handgrip exercise and the diastolic blood-pressure reading before handgrip began.

A rise of diastolic blood pressure of

a) 16 mm Hg or more was considered normal

b) 11 to 15 mm Hg was considered border line

c) 10 mm Hg or less considered as abnormal response.

RESULTS

The mean age of subjects was 28.57 years and that of controls was 26.83 years. Anthropometric data did not reveal any significant difference among the groups. There was no significant difference in following sympathetic autonomic function tests parameters between controls and subjects:

1) Blood pressure response to standing.

2) Blood pressure response to sustained hand grip.

However the following parasympathetic autonomic function tests parameters between controls and subjects showed significant difference:

1) Heart rate variation during deep breathing (Expiration: Inspiration ratio)

2) Immediate heart rate response to standing (30: 15 ratio)

The values for above tests were significantly lower in migraine subjects than controls

Table No. 1. Anthropometric data of controls and subjects

Parameters	Controls (mean ± SD)	Subjects (mean ± SD)	't' value	'P' value
Age (years)	26.83±4.04	28.57±5.44	1.467	0.14(NS)
Height (cm)	153.1±7.09	153.8±5.38	0.429	0.668(NS)
Weight (kg)	48.53±6.84	51.23±7.76	1.45	0.152(NS)
BMI (kg/m²)	20.74±2.98	21.52±3.21	1.01	0.314(NS)

NS- Not Significant, S- Significant

Table No. 2. Resting heart rate, SBP and DBP in Controls and Subjects

Parameters	Controls (mean ± SD)	Subjects (mean ± SD)	't' value	'P' value
Resting heart rate (beats/min)	74.47±8.63	79.47±9.05	2.14	0.036(S)
SBP (mm Hg)	109.6±9.72	115.6±6.99	2.07	0.007(HS)
DBP (mm Hg)	68.6±6.73	71.73±12.65	1.18	0.23(NS)

NS- Not Significant, S- Significant, HS- Highly Significant

Table No. 3. Expiration: Inspiration ratio, 30:15 ratio, Fall in SBP on standing and Rise in DBP during Hand grip test

Parameters	Controls (mean ± SD)	Subjects (mean ± SD)	't' value	'P' value
Expiration: Inspiration ratio	1.69± 0.19	1.51± 0.18	3.82	0.0003(VHS)
30:15 ratio	1.52± 0.26	1.34± 0.25	2.671	0.0098(HS)
Fall in SBP (mm Hg) on standing	3.8± 2.25	4.73± 3.62	1.201	0.234(NS)
Rise in DBP (mm Hg) in Hand grip test	19.47±2.73	15.67±12.31	1.651	0.104(NS)

NS- Not Significant, S- Significant, HS- Highly Significant, VHS- Very Highly Significant

DISCUSSION

Anthropometric data:

The mean age of migraine subjects is 28.57 ± 5.44 years and that of controls was 26.83 ± 4.04 years. Age group did not show any significant difference between migraine subjects and control group. All subjects and controls were females, thus avoiding age and gender differences in autonomic function tests.

Other anthropometric data did not show any statistically significant difference.

Resting heart rate:

The resting heart rate in migraine subjects was 79.47 ± 9.05 and that of controls was 74.47 ± 8.63. The resting heart rate was statistically higher in migraineurs as compared to the controls. This may indicate a slight parasympathetic hypo-activity or sympathetic hyper-activity.

Systolic and diastolic blood pressure:

The SBP was 115.6 ± 6.9 mm Hg in migraine subjects compared to 109.6 ± 9.72 mm Hg in controls. The SBP was significantly more in migraineurs when compared to the controls. The DBP was 71.73 ± 12.64 mmHg in migraineurs compared to 68.6 ± 6.73 mmHg in controls. There was no significant difference in DBP between migraineurs and controls although the DBP was numerically higher in migraineurs.

AUTONOMIC FUNCTION TESTS

Parasympathetic function tests:

1) Heart rate variation during deep breathing:

In migraineurs the Expiration: Inspiration ratio was 1.51 ± 0.18 as compared to the controls where in the Expiration: Inspiration ratio was 1.69 ± 0.19. The heart rate variation was statistically lower in migraineurs as compared to the controls. The decreased magnitude of heart rate variability in migraineurs may indicate reduced parasympathetic activity. Recep Aygul et al also recorded statistically lower heart rate variation during deep breathing in migraineurs, suggesting reduced parasympathetic activity.[6] This was further supported by the study done by Pfeifer MA and Petersen H, who stated that the RR variation is a measure of variation in heart rate with inspiration and expiration. The absence of or a reduction in beat to beat variation may indicate an abnormality in either parasympathetic or sympathetic function.[7]

Similar response to deep breathing in migraineurs was recorded by Ebrahim Elmenshawy and Sherif Sakr.[8] The heart rate varies with phases of respiration; it accelerates during inspiration and decelerates during expiration. This sinus arrhythmia is primarily due to fluctuations in parasympathetic outflow to the heart. During inspiration, impulses in the vagi from the stretch receptors in the lungs inhibit the cardio inhibitory area in the medulla oblongata. The tonic vagal discharge that keeps the heart slow decreases and the heart rate rises. Therefore it has been used as an index of cardiac vagal function.

2) Immediate heart rate response to standing, 30:15 ratio (Ewing's ratio)

30:15 ratio (immediate heart rate variation to standing) was significantly lower in migraineurs (1.34 ± 0.25) as compared to controls (1.52 ± 0.26). The initial cardiac acceleration upon standing is an exercise reflex which withdraws parasympathetic tone and the subsequent changes are baroreceptor mediated which enhance sympathetic tone. Most of the heart rate changes are due to parasympathetic withdrawal.[9] A lowered 30:15 ratio in our subjects thus suggests a lowered basal parasympathetic tone.

Ebrahim Elmenshawy and Sherif Sakr also found significantly lower heart rate variability in response to immediate standing in migraineurs.[8] The heart rate response to standing evaluates the cardiovascular response elicited by a change from horizontal to a vertical position. The typical heart rate response to standing is largely attenuated by a parasympathetic blockade. In healthy subjects there is a characteristic and rapid response to standing in terms of increased heart rate that is maximal at approximately the 15th beat after standing. This is followed by a relaxation bradycardia that is maximal at approximately the 30th beat after standing.[10]

The above two parasympathetic tests show statistically significant lower values, suggesting hypoactivity of parasympathetic system in migraineurs compared to the controls.

Apel et al have used a spectral analysis of heart rate fluctuations via 24-hours Holter ECG monitoring to determine the autonomic control of the heart in migraine cases, and reported spectral analysis findings indicating parasympathetic hypofunction.[11]However there are also other studies which report parasympathetic hyperfunction in contrary to our findings.[12, 13]

Sympathetic function tests

1) Systolic blood pressure response to immediate standing:

Fall in SBP on immediate standing in migraineurs was 4.73 ± 3.62 mm Hg as compared to the controls where in it was 3.8 ± 2.25 mm Hg. Although the fall in SBP was more in migraineurs and it was within the normal range, there was no statistically significant difference between migraineurs and controls.

2) Diastolic blood pressure response to sustained handgrip: Rise in DBP in response to sustained isometric handgrip in migraineurs was15.67±12.31 mm Hg where as in controls it was 19.47 ± 2.73 mm Hg. Although migraineurs' group has less rise in DBP when compared to controls and it was within the normal range, there was no statistically significant difference between migraineurs and controls.

The above two sympathetic tests suggest that there is no significant difference in sympathetic function tests between migraineurs and controls and the sympathetic nervous system is intact in migraineurs.

Thomsen et al. have also reported intact sympathetic functions in migraine cases both with and without aura.[14] H Havanka-Kanniainen et al in their study they have also found that there was no significant difference between the group of young migraine patients and the control group with respect to the BP response to standing and handgrip test.[15] Bassam Mahmood Flamerz et al. In their study also they have found no statistically significant difference in sympathetic function tests between migraineurs and controls. [16] Previous other studies in migraineurs have reported that the parasympathetic part of autonomic nervous system is affected more than sympathetic.[17, 18] Bugdayci G et al. In their study they measured salivary alpha amylase activity to investigate sympathetic activity in migraineurs. They found the dynamic nature of sympathetic nervous system activity in migraineurs i.e. they found that salivary alpha amylase level was lower during migraine attack, higher in the post attack period and there was no significant difference during normal interval period in migraineurs when compared to the controls.[19]

Several previous clinical studies investigated a possible dysfunction of the autonomic nervous system in migraineurs, but a large variety of measures have been used to assess autonomic function, and the results are consequently controversial. [4, 20, 18, 21] Sympathetic hypofunction, [4, 20, 22 – 25]sympathetic instability or hyperfunction, [11, 26] and/or parasympathetic dysfunction [4, 14, 23] have been described or suggested in migraine. Other authors reported mild sympathetic hyperactivity in migraineurs, without evidence for an impairment of the autonomic cardiovascular control.[27] These contradictory results were probably caused by many factors that can bias autonomic function tests: such as age, weight, gender, test selection and patient selection.

CONCLUSION

1. Autonomic dysfunction was found in migraine patients.

2. The values in the tests assessing parasympathetic division were significantly lower in migraineurs compared to the controls, suggesting decreased parasympathetic activity.

3. Sympathetic function test values did not show significant difference between migraineurs and controls

4. Thus Parasympathetic system is found to be selectively affected in migraineurs.

Conflict of Interest: There is no conflict of interest whatsoever regarding the present study

Source of Funding: The funding for the study was done by self

Ethical Clearance: Ethical clearance was obtained by the ethical committee of the institute KIMS, Hubli

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A Study on the Prevalence of Depression in Diabetes Patients and the Determinants of Depression among Patients with Diabetes-Related Symptoms and Complications

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ABSTRACT

Introduction: A significant number of people with diabetes suffer from depression. This can interfere with their ability to participate in self-care activities essential for good glycemic control such as diet control, physical activity, medication adherence, and self-monitoring of blood glucose. Certain specific diabetic symptoms and complications also predict depression. A strong body of evidence supports the association of depression with poor glycemic control; risk for diabetes complications and mortality.

Objective: To find out the prevalence of depression in diabetes patients among outpatients and inpatients in a medical college teaching hospital

In patient with diabetes-related symptoms and complications -to find out the determinants or predictors of depression

Materials and Method: 100 Patients with diabetes including inpatients and outpatients at BGS GIMS Hospital were screened for depression with the 9-item Patient Health Questionnaire (PHQ-9) along with a questionnaire to assess for any diabetes related symptoms and complications. The data was analysed to findout the prevalence of depression and to compare the frequency of diabetes related symptoms and complications among depressed and non depressed diabetic patients

Results : 31% of diabetic tested positive for depression using PHQ9 screen.

Other symptoms correlated with depression include symptoms related to poor diabetes control-polyuria, polydipsia ,fatigue and dizziness, painful peripheral neuropathy, End organ damage related to diabetes-kidney failure, heart failureand Disabilities related to diabetes-vision loss due to retinopathy, neurodeificits due to stroke and amputations due to diabetic foot.

Interpretation and Conclusion : Approximately 1/3 of diabetic patients have depression. Symptoms due to poor diabetes control, painful neuropathy, end organ damage and disabilties due to diabetes were also common in depressed diabetics.

Keywords : *Diabetes Mellitus, Depression, PHQ-9*

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INTRODUCTION

Diabetes is a chronic, progressive disease that causes significant morbidity and mortality. Recent studies have documented two fold odds of depression in individuals with diabetes compared to individuals without diabetes. Depressed diabetics are poorly compliant withdiet and also have higher sugars with poorer metabolic

control as assessed by their HBA1C. Depression is also associated with increased complications of diabetes , decreased quality of life and increased use of health care resources. [1]In addition, depression has also been associated with decreased adherence to weight loss intervention   and increased risk for retinopathy.The relationship between diabetes and depression may be a response to the psychosocial stress caused by diabetes or to the biochemical changes related to high blood sugars. Both conditions are widely prevalent, and may coexist coincidentally. Two studies conducted in the U.S. and Finland support the hypothesis that depression may be related to the psychosocial burden of diabetes. However, two other studies have documented that depression increases the risk of development of diabetes . Arecent review article has indicated that depression resulting from the psychosocial burden of diabetes is likely[2]

MATERIALS AND METHODOLOGY

This study was conducted at BGS Global institute of medical sciences hospital Bangalore . 100 patients with diabetes who came to outpatient department of general medicine including medical inpatient admissions with diabetes were screened for depression.

Several valid and reliable screening instruments are available for use in primary care. The 9-item Patient Health Questionnaire (PHQ-9) is an easy-to-use depression screening instrument. The PHQ-9 is a brief questionnaire that scores each of the 9 DSM-IV-TR criteria for depression as «0» (not at all) to «3» (nearly every day) providing a 0 to 27 severity score.

 A PHQ-9 score of 10 or more has a sensitivity of 88% and a specificity of 88% for major depression. PHQ-9 scores of 5, 10, 15, and 20 represent mild, moderate, moderately severe, and severe depression, respectively.[3,4]

A total 100 Patients with diabetes who attended medical OPD in BGS GIMS Hospital were included in the present study after obtaining written ,voluntary ,informed consent. They were asked a set of a detailed questions as per the proforma, regarding their diabetes control and also their previous case histories where looked into to answer the following questions.

Duration of diabetes

Current control of diabetes to include HBA1c,FBS,PPBS

Symptoms of uncontrolled diabetes, such as excessive thrist, dryness of mouth, increased frequency of urination, dizziness, tiredness/fatigue and weakness.

History of any diabetic complications such as painful neuropathic symptoms, visual symptoms which suggest retinopathy. Any evidence of chronic kidney disease heart attacks and heart failure, strokes and amputations.

All 100 patients were subjected to depression screening questionnaire-PHQ-9 in local language, Kannada, by the medical professional and any degree of depression assessed by scoring method of PHQ-9 to suggest mild, modarate, or severe depression.

The data was analysed to findout the prevalance of depression and to compare the frequency of diabetes related symptoms and complications among depressed and non depressed diabetic patients.

To find out the determinants or predictors of depression among the various diabetes related symptoms and complications.

Ethical Clearance : Ethical clearance was obtained from bgs global institute of medical sciences to conduct study

RESULTS

31 diabetic patients scored positive for moderate to   severe depression on PHQ-9 testing. Out of these 31 diabetic patients 22 had poor control as suggested by FBS, PPBS and HBA1C

17 patients had poor adherence with their antidiabetic treatment as suggested by direct questioning.

12 had symptoms of polyuria, polydypsia,dryness of mouth

19 patients had symptoms of tiredness/ excessive fatigue

17 patients had painful burning sensation in their legs

4 patients had severely reduced vision due to diabetic retinopathy.

2 patients had stroke with residual disability.

3 patients had heart failure and shortness of breath limiting activity

3 patients who were on dialysis due to kidney disease.

3 patients had amputations in the feet.

31% of diabetic tested positive for depression using PHQ9 screen. There was no correlation between duration of diabetes and depression

More patients with depression had poor adherence to therapy. Other symptoms correlated with depression include symptoms related to poor diabetes control-

1. Polyuria, polydipsia ,fatigue and dizziness

2. Painful peripheral neuropathy.

Total no of patients found to be depressed --31

3. End organ damage related to diabetes-kidney failure, heart failure

4. Disabilities related to diabetes-vision loss due to retinopathy, neurodeificits due to stroke and amputations due to diabetic foot

1. Depression score as assessed by PHQ

Score	Number of patients
6-10	17
11-15	9
16-20	5

2. Comparison of Diabetes control and complications among Depressed and Non depressed patients

Sl.No	Parameter	Total No.	Non Depressed	Depressed
1	Poor control of diabetes as suggested by F B S ,P P B S,HBA1C	32	10	22
2	Symptomatic diabetes – polyuria, polydypsia, weight loss, fatigue	19	7	12
3	Painful neuropathic symptoms	20	3	17
4	Diabetic retinopathy with reduced vision	5	1	4
5	Stroke with residual disability	3	1	2
6	Heart failure and exercise limitations	5	2	3
7	Late stage Kidney disease /dialysis.	5	2	3
8	Lower limb Amputations	5	2	3
9	Adherence with antidiabetic treatment	27	10	17

DISCUSSION

A significant proportion of depression in adults with diabetes is unrecognized. One of these reasons is the difficulty physicians have in separating the symptoms of depression from symptoms of poor management of diabetes (eg, fatigue, weight gain or weight loss, appetite changes, and sleep disturbances)

Other important reasons for poor recognition of depression are the stigma and negative perceptions associated with depression. Many patients do not acknowledge depression and even when they do, they do not report symptoms or agree to treatment because depression is perceived as emotional weakness or personal failure.

A strong body of evidence supports the association of depression with poor glycemic control. In a meta-analysis of 24 studies, Lustman and colleagues[examined the relationship between depression and glycemic control. They found that depression was significantly and consistently associated with poor glycemic control in both type 1 and type 2 diabetes, with effect sizes in the small-to-moderate range depending on whether the diagnosis of depression was based on screening or diagnostic interviews.[5]

Evidence also supports the relationship between depression and risk for diabetes complications. In a meta-analysis of 27 studies that included adults with type 1 and type 2 diabetes, de Groot and colleagues found that depression was significantly associated with the following diabetes complications: diabetic retinopathy, nephropathy, neuropathy, microvascular complications, and sexual dysfunction.[6]

In the Hispanic Established Population for Epidemiologic Study of Elderly (EPESE) survey, depression was significantly associated with microvascular and macrovascular complications in elderly Mexican A mericans with type 2 diabetes.[7] Multiple studies have established that depression increases the risk for death in adults with diabetes. In a study of 10,704 Medicare beneficiaries in the United States, Katon and colleagues reported that beneficiaries with diabetes and comorbid depression had a 36% to 38% increased risk for all-cause mortality over a 2-year period.[8]

In another study of 10,025 patients from the NHANES I Epidemiologic Follow-up Study who were followed for 8 years, Egede and colleagues found that the risk for death was two and a half times higher in individuals who had both diabetes and depression compared with those without diabetes or depression. The authors also found that this risk was more than that resulting from having either diabetes or depression alone.[9]

Certain behaviors are essential for good glycemic control, including diet, physical activity, medication adherence, and self-monitoring of blood glucose. However, multiple studies have shown that depression negatively influences these essential self-care behaviors. A systematic review of treatment adherence showed that depression was significantly associated with missed medical appointments and poor self-care behaviors in individuals with diabetes.[10] Other systematic reviews have found that depression was associated with poor medication adherence in patients with diabetes and that it is also linked with poor adherence to dietary recommendations.[11,12]

The depressive disorders include major depression, minor depression, and dysthymia. According to the American Psychiatric Association *Diagnostic and Statistical Manual of Mental Disorders,* Fourth Edition, Text Revision (DSM-IV-TR)*,* the clinical diagnosis of major depression is based on the presence of any 5 of the following like Depressed mood or anhedonia (ie, markedly diminished interest or pleasure in activities) during the same 2-week period and significant weight loss when not dieting or weight gain; Insomnia or hypersomnia; psychomotor agitation or retardation; Fatigue Feelings of worthlessness or excessive or inappropriate guilt; Diminished ability to think or concentrate; andRecurrent thoughts of death, suicidal ideation, or a suicide attempt.[13]

The updated evidence review of screening for depression in primary care by the United States Preventive Services Task Force found that such programs were most likely to be effective if there was staff-assisted support for assessment, monitoring, and care management or coordinated referral to specialty mental health treatment. Based on the updated review, screening without appropriate systems in place for monitoring is not recommended. PCPs need to have a system in place to confirm the diagnosis, offer guideline-concordant treatment, and refer complex patients or patients who do not respond to an adequate dosage of 2 antidepressant medications to specialty mental health treatment programs. Because patients may conceal intent, providers should obtain additional information from collateral sources when possible.[14] These sources may include spouses or partners, family members, colleagues, and friends. Suicide risk assessment should be an ongoing process, and the risk for suicide should be monitored over the course of treatment.[15]

Once a clinical diagnosis of depression is established and the patient has been evaluated for suicide risk, the options for treatment in primary care are pharmacotherapy and psychotherapy. Because few primary care practices(PCP) are set up to offer evidence-based psychotherapy for depression, the viable option

for most PCPs is pharmacotherapy. In general, the evidence suggests that pharmacotherapy and evidence-based psychotherapy are equally effective treatment options and that all classes of antidepressant medications are equally efficacious.Newer pharmacotherapies such as the SSRIs, SNRIs, and DNRIs are easier to dose, better tolerated by patients, and have fewer side effects and drug-drug interactions than the older agents such as TCAs or monoamine oxidase inhibitors (MAOIs).[16,17]

In summary, the literature shows that depression is highly prevalent in adults with diabetes, is underrecognized in primary care, and has significant adverse effects on glycemic control, diabetes self-care, complication risk, functional status, quality of life, and mortality.

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Study of Gender Correlation with Weight, Height, and BMI on Hemoglobin

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ABSTRACT

Background: The increasing trouble of anaemia in India and its negative effects on academic performance of students, it is necessary to find out the prevalence in undergraduate college students. In present study, an attempt has made to study body mass index and hemoglobin estimation on medical students. Healthy male and female have different haemoglobin levels. This sex difference is independent of iron status — iron replete premenopausal women have mean haemoglobin levels approximately 12% lower than age & race matched men. Aim of the study is to correlate the hemoglobin with body mass index between male and female medical students.

Method: Healthy medical student volunteers (N=64), males [45] and females [15], ranged in age from 18 to 25 years, participated in the present study. After taking consent, linear height measured by measuring tape mounted on the wall and Weight recorded by weighing machine. Data of Haemoglobin gm/dl (Sahli's Method), and BMI (Kg/m2) was analysed. The relationships between the continuous variables were examined by Pearson's linear correlation test. Significance accepted at the level of $P \leq 0.05$. Further grading of BMI was done as per the WHO criterion.

Results: In all subjects (n=64) Hemoglobin (13.26±1.94), Height (1.71±0.07), Weight (64.11±13.24) and BMI (22.20±3.98) were estimated. Correlation between Wt and Hb was r=0.1322 has non-significant positive correlation. Correlation between BMI and Hb was r=0.017628 also has non-significant positive correlation. Whereas Correlation between Ht and Hb was r=0.316576 has significant positive. There was significant difference between Ht (p<0.001), Wt (<0.001) and near significance was Hb(p<0.05) between males and females. There was significant difference (p<0.05) between mean BMI (Kg/m2) of males (22.7±4.08) and females(20.4±2.85). In conclusion, there is a correlation between BMI and Hb status, anaemia is more prevalent in female college students, and the problem of anaemia should address seriously.

Conclusions: Study showed that there was difference in HB and BMI between males and female subjects which was statistically significant, however correlation of HB with BMI between males and females showed slight variation, but statistically it was not significant. There was a significant difference between the Ht and Wt levels in both males and females. There was a correlation between Ht and Hb status showing uphill linear relationship. BMI had no correlation with hemoglobin.

Keywords: Haemoglobin (Hb), Height (Ht), Weight (Wt), BMI.

INTRODUCTION

Healthy male and female have different haemoglobin

levels. This sex difference is independent of iron status — iron replete premenopausal women have mean haemoglobin levels approximately 12% lower than age & race matched men. The mean circulating erythropoietin level does not differ between male and female, and in women does not differ between pre and postmenopausal women, indicating that the sex difference is constitutive, and that women do not attempt to achieve male levels in

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health .In general, in healthy humans, the hemoglobin level correlates to a modest extent with the red cell mass, though the correlation is different for adult men and women. The physiological factors may be constitutive or chronic, such as puberty and menopause, acclimatisation to altitude, level of fitness or lean body mass, or acute such as posture or level of hydration. This lack of precise correlation exists both for individuals and for populations. Thus while red cell mass is on average lower per unit mass of tissue in females, the red cell mass in individuals in either sex cannot be estimated precisely from the haemoglobin level. Nevertheless, for most clinical purposes hemoglobin levels can use to imply red cell mass in individual, although the imprecision in this approach becomes apparent in the management of the apparent polycythaemia of chronic hypoxic lung or cardiac disease.[1]

Anaemia is a worldwide problem with the highest prevalence of nutritional deficiency in developing countries. It frequently occurs due to inadequate iron intake, chronic blood loss or disease, malabsorption or a combination of all these factors.[2] The most significant contributor to the onset of anaemia is iron deficiency. The other causes of anaemia are heavy blood loss, parasitic infections, acute and chronic infections, micronutrient deficiency, and hemoglobinopathies.[3] It affects one's development, growth and resistance to infections and is associated with mortality among younger adults than two years old.[2]

Anaemia among women causes many serious health problems and is pervasive in developing countries. Anaemia can result in adverse pregnancy outcomes, and severe anaemia can lead to maternal deaths, reduced work productivity and impaired physical capabilities. (ICRW) Iron deficiency anaemia is the third leading cause of DALY(disability adjusted life years) for females aged 15-45 years. In country like in India, adolescent girls face serious health problems due to socioeconomic conditions, nutrition and gender discrimination.[2]

Medical fraternity is among the literate and well-informed sector of the society. Medical students at a medical college are well informed and have easy accessibility to healthy food. Considerable changes in the lifestyle & behaviour, increased consumption of easily and cheaply available fast foods, inadequate and inappropriate dietary habits & mechanical job profile are likely to increase the prevalence of nutritional disorders including anaemia even in the affluent young adults. Since children and young adults are our future, therefore it is important for us to assess their problems at an early stage so that strategic intervention can be planned. Therefore, this study planned to assess the level of anaemia in the educated class of young medical students who have easy access to adequate diet.[4]

The present study conducted to asses this problem at an early stage so that strategic intervention can planned. This study planned to determine and correlate haemoglobin concentration between males and females in relation to body mass index.

MATERIAL AND METHOD

60 healthy medical students studying at BRD Medical College belonging to both sexes were taken for the purpose of the study. The study was conducted in department of physiology during the month of March 2017. After informed consent, the students were asked to report to the department at morning hours. Anthropometry conducted using standard protocol.

1. Haemoglobin Levels (gm/dl) estimated using Sahli's method.

2. Age was recorded from birthday by calendar to the nearest of year (<6 months and >6 months)

3. Standing height was recorded without shoes and with light cloths on a wall mounted measuring tape to the nearest of centimetres. (<5 mm and >5 mm)

4. Weight recorded without shoes and with light cloths on a Krups weighing machine with a least count of 500 grams.

5. BMI was calculated by the formula

FINDINGS

In all subjects (n=64) Hemoglobin (13.26±1.94), Height (1.71±0.07), Weight (64.11±13.24) and BMI (22.20±3.98) were estimated (Table 1).

Table 1: Descriptive Statistics for variables under study

Variables	Mean ±SD
Age (years)	23.03±2.13
Hb (gm%)	13.2±1.94
Wt (kg)	64.1±13.24
Ht (mts)	1.7±0.07
BMI (kg/m^2)	22.2±3.98

Table 2: Correlation coefficient (r) among variables with Hb under study

Variables	Hb
Wt	0.13
Ht	0.31
BMI	0.01

Significance at the level of $P \leq 0.05$

Table 3: Comparison of variables between Genders

Genders	Hb (mean ± SD)	Wt (mean ± SD)	Ht (mean ± SD)	BMI (mean ± SD)
Male	13.5±1.84	67.5±12.23	1.7±0.05	22.7±4.08
Female	12.3±1.92	52.9±9.18	1.6±0.05	20.4±2.85
p-value	0.05	0.00*	0.00*	0.02*

*statistically significant as $P < 0.05$

Table 4: Correlation coefficient (r) among variables in males with Hb

Variables	Hb
Wt	0.05
Ht	0.10
BMI	0.01

Significance at the level of $P \leq 0.05$

Table 5: Correlation coefficient (r) among variables in females with Hb

Variables	Hb
Wt	-0.17
Ht	0.48
BMI	-0.35

Significance at the level of $P \leq 0.05$

Correlation between Ht and Hb was r= 0.48 has significant positive correlation explains increase in height will facilitate rise in Hb (fig 7). Whereas Correlation between BMI and Hb was r= -0.35 also has significant negative correlation (fig 9) it shows weak negative linear correlation which explains rise in BMI will decrease Hb. Increase in the prevalence of lowering of Hb in girls can explain by steady increase in body mass index that

Correlation between Wt and Hb was r=0.1322 has non-significant positive correlation and less explainable (fig 1). Correlation between Ht and Hb was r=0.316576 has significant positive correlation and shows weak linear diagram (fig 2). Whereas Correlation between BMI and Hb was r=0.017628 also has non-significant positive correlation and unexplainable (fig 3).

Fig: 3 Scatter Diagram between Hb and BMI for both genders.

can correlate nutritional status and variation in growth and development. Correlation between Wt and Hb was r= -0.17 has non-significant negative correlation and unexplainable (fig 8). Negative association in present study could related to the reduction in levels of oestrogen binding protein levels with increasing adiposity (BMI) with concomitant increase in insulin. Therefore level of free oestrogen may rise up which may cause suppression of erythropoiesis in females.[6]

DISCUSSION

Present study showed that there was difference in HB and BMI between males and female subjects which was statistically significant, however correlation of HB with BMI between males and females showed slight variation, but statistically it was not significant. There was a significant difference between the Ht and Wt levels in both males and females. There was a correlation between Ht and Hb status showing uphill linear relationship. BMI had no correlation with hemoglobin.

Increase in the prevalence of lowering of Hb in girls can explain by steady increase in body mass index that can correlate nutritional status and variation in growth and development. There was no significant correlation between BMI and haemoglobin was observed in our study among girls who were overweight & obese in both groups. Similar result was observed in one study among

nonschool going adolescent's girls and it was statistically significant.[6] In other study on 600 Iraqi adolescents girls also found statistically significant negative association between BMI & Hb (r-0.185, p<0.01) which included both schooling and non-schooling population of Baghdad.[7] Negative association in present study could be related to the reduction in levels of oestrogen binding protein levels with increasing adiposity (BMI) with concomitant increase in insulin. Therefore level of free oestrogen may rise up which may cause suppression of erythropoiesis in females.[5]

In males a positive association was observed between BMI and Hb and was similar to the finding observed in Iraqi boys[7], however the association was statistically significant. It has suggested that in males the achievement of adult testosterone concentration is associated with an increase in erythropoesis and Hb concentration.[8]

A study found that with the onset of menarche at puberty & in the absence of adequate dietary intake, young girls become highly susceptible to anaemia. After the analysis, it found that anaemia is more prevalent among the students who are underweight and overweight students have less prevalence of anaemia.[9]

The present study also points to the fact that most of the female students of higher age group were closure to the lower levels of the hemoglobin (~ 12 g%). Studies from other parts of India shows a similar trend with prevalence of anaemia among adolescents girls increased from 10 years upwards and remained higher until 18 years of age.[5] Increase in the prevalence of anaemia with age in girls can be explained by steady increase in the body mass which can correlated to nutritional status and variation in growth & development. The low prevalence of anaemia among adolescents reported in our study can be due to adequate nutrition and healthy environment conditions free from diseases prevailing.

Nutritional anaemia is prevalent even in medical students who are literate, and have free access to the nutritive diet in a good healthy environment. However in order to quantify and access the anaemic levels properly, with respect to the altitude, diet and other factors, the study of other biochemical parameters are required.[10]

CONCLUSION

This study showed that there was difference in HB and BMI between males and female subjects that statistically significant. There was a significant difference between the Ht and Wt levels in both males and females. There was a correlation between Ht and Hb status showing uphill linear relationship. Reasons for low prevalence of anaemia in our study could be because the study was done on urban population with better health conditions & in high socio economic status group. Although diet of boys and girls is similar, the low food intake, increased tendency to loose weight for zero size, combined with menstrual loses cause girls to be more prone to the nutritional anaemia.

Ethical Clearance: The Institutional Ethics Committee approved the study

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Effect of Classical Music on Foetoplacental Circulation in Pregnancy Induced Hypertension Using Color Doppler Indices

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ABSTRACT

Aim of present study was to see the effect of classical music on foetomaternal circulation in pregnancy induced hypertension using color doppler indices. Fifty subjects were divided into two groups: Group A of 25 subjects of pregnancy induced hypertension not subjected to listen music and Group B of 25 subjects of Pregnancy induced hypertension who were daily listening to music for a month. All the subjects were lying in age group of 25-32 years and having 28-34 weeks of gestation. Detailed history & complete general examination was done. BP was taken on two occasions at least 6 hours apart. Systemic and obstetrical examination was done in all subjects. Color doppler was done to assess the blood flow in bilateral umbilical arteries by measuring various doppler indices ultrasonologically : Pulsatility Index(PI), Resistivity index(RI) & Systolic diastolic ratio(S/D ratio). Then each subject of Group B was subjected to listen classical music daily for half an hour for one month at home during the period of relaxation in lying down position. Ultrasonologically foetal blood flow was again evaluated by color doppler method after one month in Group A & Group B. In both groups, the decreased vascular resistance was found with progression of pregnancy but Group A showed an increase resistance for that gestational age as compared to Group B suggesting decreased blood flow in foetomaternal circulation in subjects who were not subjected to listen music. Pulsatility Index among all three umbilical artery doppler indices were found to be most sensitive indicator of foetoplacental insufficiency. Thus we concluded that classical music has a therapeutic effect in Pregnancy induced hypertension in improving foetomaternal circulation.

Keywords: *classical music, pregnancy induced hypertension, color Doppler indices.*

INTRODUCTION

Pregnancy can be a difficult period presenting physiological & psychological challenges for woman. Many women experience considerable stress during pregnancy. High levels of stress and anxiety can have a negative impact in progression of pregnancy and can increase the incidence of high risk pregnancies as Pregnancy induced hypertension. Music therapy may help in improving the patient's quality of life and pregnancy outcome[5].

Pregnancy induced hypertension: It is defined as hypertension that develops as a direct result of gravid state with an absolute rise of BP of at least 140/90 mm Hg, if previous BP is not known/rise in systolic BP of at least 30 mm Hg or a rise in diastolic BP of at least 15 mm Hg over the previously known BP/mean arterial pressure of 105 mm Hg or more. When BP rises, blood vessels constrict. Thus reduced blood supply to placenta, so less oxygen and nutrients reaching the foetus. Other vital organs in mother's body are also receiving a reduced blood flow[1].

The introduction of relaxation has come to be regarded as a positive element in allaying stress and anxiety[9]. Music can be effective in facilitating relaxation & reducing stress & anxiety during pregnancy[6]. Listening to music is therapeutic in its own right and also has power to reduce BP. Studies have proved that listening to music even stimulates production of NO, one

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of the body's most powerful regulator of BP. All these facts support the potential of obstetrical music therapy to make a significant contribution to maternal and neonatal health[7]. This study is a further step in the field to further strengthen these facts by using color Doppler indices and to find something newer.

MATERIAL & METHOD

Present study was conducted at Om Imaging Diagnostic Centre, Meerut. Fifty subjects were divided into two groups as Group A(control group) of 25 subjects of pregnancy induced hypertension not subjected to listen music and Group B (study group) of 25 subjects of Pregnancy induced hypertension who are daily listening music for one month .All subjects were lying in age group of 28-32 years with 28-34 weeks of gestation. Informed consent was obtained from all subjects recruited in this study.

Inclusion Criteria:

Pregnant females with PIH, females fond of classical music.

Exclusion Criteria:

Ecclampsia, Gestational Diabetes, Severe Anemia & any other medical disorders in pregnancy .

The patient was evaluated by detailed history & complete general examination i.e. Pulse rate, Resp. rate, pallor, oedema, BP was taken. BP was taken with the patient lying on her side at 30 degrees to the horizontal. Bp was measured on two occasions at least 6 hrs apart. Systemic examination including assessment of CVS, CNS and Respiratory system was done. Obstetrical examination was done in all subjects.

ULTRASOUND ASSESSMENT OF FETAL GROWTH:

It was done by using ultrasound machine with 3.5 MHz curvilinear probe. Then Group B subjects were subjected to listen music daily for half an hour for one month at home during the period of relaxation in lying down position. Classical music was selected on patient's preference. Each mother was strongly encouraged to listen music at home for half an hour daily for four weeks in lying down position. BP was recorded and blood flow was evaluated by color doppler method ultrasonologically after one month in both groups. In Umbilical artery, Color Doppler indices were taken as follows:

Systolic/diastolic ratio(S/D ratio)

Pulsatility Index(PI)=S-D/Mean Velocity.

Resistivity Index(RI):S-D/S.

Where S=Peak Systolic Velocity, D=End Diastolic Velocity.

STATISTICAL ANALYSIS

All values were expressed as Mean±SD. Unpaired t test was used to compare the values in both Groups A & B before & after listening music.$P \leq 0.05$ was considered statistically significant. The data was analysed using statistical package of Analytical Software SPSS.

RESULTS

Just at the start of study, before study group was subjected to listen music, color doppler indices (PI, RI & S/D) of umbilical artey were compared between control & study groups. No statistically significant difference was found in all three doppler indices of umbilical artery whereas significant decrease in values of all three color doppler indices was found in Group B after one month of music therapy as shown in Table A & Table B respectively. Out of three, PI was found to be most significantly decreased (P= 0.001) & S/D was least significantly decreased (P= 0.035) in Group B as shown in Table 2.

TABLE 1: Comparison of Doppler indices in between control & study groups(n=25 in each group)

Doppler Indices	Group A	Group B	P value
PI	0.597± 0.187	0.738±0.362	0.090
RI	0.416±0.085	0.496±0.118	0.050*
S/D	1.756±0.272	1.798±0.584	0.746

TABLE 2: Comparison of Doppler indices in between control & study groups after subjected to music (n=25 in each group)

Doppler Indices	Group A	Group B	P value
PI	0.990±0.092	0.873±0.131	0.001***
RI	0.140±0.050	0.598±0.049	0.005**
S/D	2.694±3.640	2.476±0.349	0.035*

Data presented are Mean±S.D; PI: Pulsatility index; RI: Resistivity index; Systolic/Diastolic ratio. The analysis of data was done using unpaired students t test; P<0.05*; P<0.01**; P<0.001***.

DISCUSSION

Decline in mean values of pulsatility index (PI) and resistivity index (RI) were found with advancing gestational age suggesting decreased vascular resistance and increased blood flow in uteroplacental and fetoplacental circulation[4]. It is supported by the fact that fetal growth during pregnancy depends on a steady supply of nutrients and oxygen from mother; a normal uteroplacental and fetoplacental circulation is necessary for this to occur. During pregnancy, the extravillous trophoblast migrates from the anchoring villi into the uterine decidua. These cells invade and surround the spiral arteries and convert these vessels from innervated and muscularized narrow vessels of high resistance to denervated, passively dilated vessels of low resistance. In addition to their invasive properties, the extravillous trophoblast cells promote maternal blood flow to the implantation site by the production of vasodilatory peptides locally in the deciduas and myometrium[2]. Umbilical blood flow increases with the gestational age and pressure gradient driving the blood flow from the descending aorta through the placenta and back to inferior vena cava. As pregnancy advances there is increasing end-diastolic flow velocity with lesser changes in peak systolic velocity[3]. There is a progressive fall in the values of Doppler indices of the Umbilical artery with increasing gestation, this decrease in the values with advancing gestation occurs due to decreased placental vascular resistance. This decrease does not occur in hypertensive pregnancies, which therefore have high values of Doppler indices[9]. Music has a positive effect on fetal well being. Music therapy has impact on various psychological factors active during pregnancy & hence it promotes relaxation[10].The findings obtained by applying music therapy to pregnant women with pregnancy induced hypertension, music therapy was found to decrease blood pressure, the positive effect on fetal movement counts, and minimalizing effect on fetal heart rate[12]. Findings are coinciding with our study but we have shown this by assessing uteroplacental flow in umbilical artery using color Doppler indices which is a more sensitive indicator[4] . In one study it was showed that music has a positive effect in decreasing labour pains[10]. In another study the effect of music on various vital signs, namely systolic blood pressure(SBP), diastolic blood pressure(DBP) & heart rate(HR) was seen. Compared to those who did not receive music therapy had a significantly greater decrease in SBP[12]. In another study it was seen that music has positive effects on blood pressures and anxiety levels in elderly patients & patients with hypertension[13]. Music therapy is an effective supplement in the treatment of PIH, as it lowered blood pressure, alleviated negative emotions, and improved quality of life[16] . During third trimester the fetus becomes more reactive to sounds & starts moving in response to external auditory stimuli such as music[4].

All these above mentioned studies had shown the positive effect of music on blood pressure and heart rate that again support our study. Preeclampsia is associated with altered uteroplacental circulation. The abnormal vascular resistance to blood flow in the uteroplacental and fetoplacental circulation can be well studied by Doppler ultrasound[14,15]. Pregnancy induced hypertension (PIH) is associated with adverse perinatal outcome which can be very well predicted by color Doppler studies[17]. In our study too we found that impedance to blood flow increases as pregnancy advances in PIH and on giving music therapy this impedance to blood flow was decreased in study group as compared to control group.

CONCLUSION

Music has a positive effect in improving uteroplacental flow in Pregnancy induced hypertension.

Color Doppler sonography is very useful in detecting uteroplacental and foetomaternal blood flow accurately especially in high risk pregnancy like Pregnancy induced hypertension. It provides a repetitive, non-invasive tool for hemodynamic monitoring of the fetal wellbeing thus helping in predicting perinatal outcome. In future a long term study can be planned showing effect of music on foetal growth using color Doppler indices.

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Assessment of Foetoplacental Blood Flow in Normal Pregnancy Vs Gestational Diabetics Using Color Doppler Indices

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ABSTRACT

The present study was undertaken to assess differences in foetoplacental blood flow in normal pregnancy and gestational diabetics using color Doppler indices which can affect fetal outcome. The study was conducted in 60 pregnant females of age group 25-35 years having 28-34 weeks of gestation divided into two groups: Group A of 30 normal pregnant females and Group B of 30 gestational diabetics. Glucose tolerance test was done in all subjects. Assessment of foetoplacental blood flow was done by measuring PI and RI in umbilical and uterine arteries with the help of color Doppler studies ultrasonologically. Impedance to blood flow was found to be significant in uterine artery as compared to umbilical artery. Resistivity index was found to be more sensitive than Pulsatility index in uterine artery blood flow. The study concluded that color Doppler can help in early assessment of increased impedance to blood flow in gestational diabetics which if timely detected by clinician may prevent intrauterine growth retardation and perinatal mortality.

KEYWORDS: *Foetoplacental blood flow, Gestational Diabetes, Color Doppler.*

INTRODUCTION

Pregnancy, an important physiological phenomenon, is generally not associated with complications. But high risk pregnancy eg pregnancy with severe anemia, pregnancy induced hypertension, gestational diabetes may affect foetal blood flow and thus the foetal growth. These complications may be avoided by frequent prenatal testing and thus decreasing perinatal morbidity and mortality. One of these prenatal tests is color doppler study using ultrasound which is non invasive, convenient, quick and without any side effect. Color doppler uses changes in velocity of blood flow in different vessels during systole and diastole and waveform representation and their analysis. As a result, vascular resistance in these vessels is inferred and fetal growth can be assessed[3].

Gestational diabetes is defined as carbohydrate intolerance of varying severity with onset or first recognition during pregnancy irrespective of whether or not insulin is used for treatment or the condition persists after pregnancy. It occurs in about 4% of pregnancies[1]. Gestational diabetes may be complicated by number of clinical sequelae eg fetal macrosmia, polyhydramnios, prematurity, placental insufficiency and intrauterine deaths[2]. Screening for the development of Gestational diabetes is necessary to enable appropriate surveillance and treatment. Thus color doppler analysis of fetoplacental circulation was planned to evaluate fetal outcome.

MATERIAL AND METHOD

Present study was conducted in Subharti medical college. Sixty antenatal cases of 28-34 weeks of gestation, lying in age group of 25-35 years were taken. Out of sixty subjects, thirty subjects were of normal pregnancy (Group A) as controls and thirty subjects were gestational diabetic(Group B) as cases.

INCLUSION CRITERIA:

Normal pregnant females

Gestational diabetics

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EXCLUSION CRITERIA:

Pregnant females with other chronic medical illness eg Pregnancy induced hypertension, severe anemia and diabetics with complications .

The subjects were evaluated by detailed history with special reference to family history of diabetes, diabetes in previous pregnancy or an abnormal glucose challenge test.[1] All subjects were subjected to complete general examination, systemic examination and obstetrical examination. All subjects were subjected to glucose tolerance test as follows:

The subjects were instructed not to restrict carbohydrate intake in the days or weeks before the test. The subjects were instructed to fast (water is allowed) for 8-12 hours prior to the test. A zero time sample was drawn. Then a glucose load of 75 gm was given orally and plasma glucose repeated at 2 hours after the glucose load. Fasting glucose at or above 7.0 mmol/l (126mg/dl) and 2 hours postprandial levels above 11.1 mmol/l(200mg/dl) were diagnostic of Gestational Diabetes[4].

Thereafter foetoplacental blood flow was assessed by color doppler study ultrasonologically in all subjects. Blood flow was recorded in umbilical and uterine arteries as:

Pulsatility Index(PI) =(S-D)/Mean Velocity

Pourcelots Resistivity Index(RI) = (S-D)/S

Where S=Peak Systolic Velocity

D=End Diastolic Velocity

Doppler indices were then compared to standard normograms. Doppler indices were considered abnormal when >2SD for the gestational age according to the reference values.[5]

STATISTICAL ANALYSIS

Using SPSS-10 version, the statistical analysis was done. Student's t test was done considering $p < 0.05$ as significance level.

RESULTS

In gestational diabetic group vs controls,significant increase was seen in Resistivity index (RI) of uterine artey doppler indices whereas no significant difference was seen in Pulsatility index(PI) though an increasing trend was seen (Table 1).

No statistical significance was seen in doppler indices of umbilical artery in between controls and gestational diabetics, though a increasing trend was seen(Table 2).

TABLE 1: Comparison of Uterine artery Doppler indices in between control & study groups(n=30 in each group)

Doppler Indices	Group A	Group B	P value
PI	0.597± 0.187	0.721±0.212	0.304
RI	0.416±0.085	0.475±0.098	0.030*

TABLE 2: Comparison of Umbilical Artery Doppler indices in between control & study groups (n=30 in each group)

Doppler Indices	Group A	Group B	P value
PI	0.873±0.135	0.943±0.492	0.496
RI	0.598±0.049	0.592±0.149	0.852

Data presented are Mean±S.D; PI: Pulsatility index; RI: Resistivity index.

DISCUSSION

Hyperglycemia may cause changes in foetoplacental blood flow during pregnancy that maylead to fetal distress, preeclampsia and intrauterine growth retardation (IUGR). Pregnancy represents a stress on islet cell function because of the effect of pregnancy hormones on carbohydrate metabolism which leads to an increase in insulin requirement in prepregnant diabetics and thus onset of a diabetic condition in pregnancy i.e. Gestational Diabetes. Maternal hyperglycemia may cause placental vasoconstriction by impairing prostacyclin production (Bracero et al,1986).[6] They found a significant association between impedance to foetoplacental blood flow and maternal serum glucose concentration as also seen in our study. In another study 40 gestational diabetics were examined and reported that RI(Resistivity index) in umbilical artery was found higher in gestational diabetics than in normal pregnancies. It was suggested that in some gestational diabetics, there is increased placental vascular resistance with a compensatory increase in volume flow (Olofsson

et al,1987)[7]. In our study RI was found to be increased but this increase was significant in uterine artery as compared to umbilical artery. In doppler studies of umbilical artery during third trimester of pregnancy no significant association was found between impedance to flow and maternal serum glucose levels (Ishimatsu et a,1991)[8] corroborating with findings of our studies. In another study serial measurements of impedance to flow in the umbilical artery were done in gestational diabetics. Impedance was within normal range as seen in our study(Zimmermann et al,1992)[9]. Significant impedance to flow in uterine artery was measured in 37 gestational diabetics (Haddad et al,1993)[10]. In our study also uterine artery is showing significant increase in impedance to blood flow as compared to umbilical artery. Hyperglycemia may cause changes in maternal – placental blood flow during the pregnancy that may lead to preeclampsia, foetal distress and intrauterine growth retardation(IUGR). Impedance to blood flow may be increased due to thickening of basement membrane, proliferation of endothelial cells and disarrangement in perivascular space with increase of collagen, proteoglycans and glycosominoglycans which are all characteristic changes occuring as a consequence of hyperglycemia.

CONCLUSION

By above study it is concluded that doppler velocimetry may estimate vascular impedance in foetoplacental circulation in early third trimester in gestational diabetics which if detected and managed timely by clinician may prevent certain complications like preeclampsia, fetal distress and Intrauterine growth retardation thus minimizing prenatal and perinatal morbidity and mortality.

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Gastrointestinal Dysfunctions after Spinal Cord Injury in Patients of Northern-Western Region of India

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ABSTRACT

The purpose of the study was to evaluate the effect of duration of injury and the level of lesion on Gastrointestinal Dysfunctions after Spinal Cord Injury patients. Outcome of 52 spinal cord injury patients using semi-structured questionnaire and was developed by international spinal cord injury society and analyzed by chi-square test. There was significant gastrointestinal dysfunctions observed including assisted methods of defecation rather than natural methods of defecation and more than average time required to complete the defecation process which were significantly increased as the duration of injury progress. This could have been improved with proper training of bowel care methods and proper education regarding the dietary intake as their life becomes usually sedentary after Spinal Cord Injury

Keywords: *Spinal Cord Injury, Gastrointestinal Dysfunction, Defecation*

INTRODUCTION

The majority of individuals with spinal cord injury (SCI) has Neurogenic bowel dysfunction including constipation, fecal incontinence and abdominal pain or discomfort.[1–4] Colonic transit times are often prolonged,[5–8] and anorectal sensibility and voluntary control of the external anal sphincter is reduced or lost.[5,9,10]

There is a need to conduct a comparison of symptoms, treatment regimes and rehabilitation programs so that a uniform data set is to be maintained among the diverse populations of the world. Henceforth a common international data sets of bowel functions after spinal cord injury patients is necessary. The Bowel Function Basic SCI Data Set should mostly be used in connection with the background information within the International SCI Core Data Set[11].

A current goal of Spinal Cord Injury rehabilitation should therefore be to improve the quality of life; to this end, the improvement of bowel function in patients with

chronic G-I problems and bowel dysfunction would help considerably. Most research related to such problems has focused on the `acute abdomen' developed immediately after SCI or an operation for it[12]

Objectives

• To assess the effect of duration of injury on bowel symptoms.

• To assess the effect of level of lesion on bowel symptoms.

RESEARCH METHODOLOGY

Interview was performed individually on 52 spinal cord injury patients who were discharged from Research and Rehabilitation center, Sawai Mansingh Hospital Jaipur; the format was semi-structured questionnaire and was developed by international spinal cord injury society[13].

Inclusion criteria:

Person after 6 months of Spinal Cord Injury & has given consent for study.

Exclusion criteria:

Severely ill patients.

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Collected data was entered and analyzed using MS-Excel version 2007. Quantitative data was presented as mean & standard deviation and qualitative data was presented as proportion. Their association was analyzed using Chi-Square Test.

Duration of the study

December 2017 to May 2018

RESULTS

52 spinal cord injury patients were selected for the study. Their demographic data is as follows:

Table 1: Shows the demographic data of the spinal cord injury patients.

Frequency		Percent
Age in years		
21-30	29	55.77%
31-40	19	36.55%
41-50	4	7.68%
Sex		
Male	50	96.15%
Female	2	3.85%
Marital Status		
Married	24	46.15%
Unmarried	28	53.85%
Occupation		
Yes	21	40.38%
No	31	59.62%

Most of the patients are male (96%). Most of the spinal cord injury patients they come in the age group of 21-40 years (92%) only 4 patients were in the age group of 41-50years (8%). The Mean±SD of age of patients suffering from spinal cord injury is 30.56 ±6.34. 46% of the patients were married while 54% of the patients were

unmarried. Out of the patients interviewed only 40% of the patients have occupation while the remaining 60% of the patients were unemployed/lost their source of employment due to disability.

Table 2: Shows the level of injury of the spinal cord injury patients.

Frequency		Percentage
Level of Injury		
Cervical	8	15.38%
Dorsal	39	75.00%
Lumbar	5	9.62%

Table 3: Shows the duration of injury (in years) of the spinal cord injury patients.

Frequency		Percent
Duration of injury		
1 to 5 year	21	40.38%
6 to 10 year	21	40.38%
11 to 15 year	6	11.54%
16 to2 0 year	4	7.69%

Out of the patients interviewed predominant (75%) of the patients were suffering from Thoracic Spinal Injury, while 15% patients and 10% patients were suffering from Cervical and Lumbar Spinal Injury respectively.

Out of the patients interviewed predominant 40% patients were suffering from spinal cord injury duration of 1-5 years, 40% had an injury duration of 6-10 years, 12% had an injury duration of 11-15 years, rest 8% had an injury duration of 16-20 years.

Characteristics of Bowel Habits and Bowel care procedures in Spinal Cord Injury patients.

Table 4: Shows the defecation method and bowel care procedures of the spinal cord injury patients within the last four weeks.

Defecation method and bowel care procedures (within the last four weeks)							
DURATION	straining/ bearing down to empty	digital ano-rectal stimulation	suppositories	digital evacuation	mini enema (clysma<150ml)	Enema> 150ml	Total
1to5year	13	3	3	2	0	0	21
	61.90%	14.29%	14.29%	9.52%	0.00%	0.00%	100.00%

***Cont....* Table 4: Shows the defecation method and bowel care procedures of the spinal cord injury patients within the last four weeks.**

6to10year	10	0	3	3	1	4	21
	47.62%	0.00%	14.29%	14.29%	4.76%	19.05%	100.00%
11to15year	1	0	0	2	0	3	6
	16.67%	0.00%	0.00%	33.33%	0.00%	50.00%	100.00%
16to20year	0	1	0	0	0	3	4
	0.00%	25.00%	0.00%	0.00%	0.00%	75.00%	100.00%
TOTAL	24	4	6	7	1	10	52
	46.15%	7.69%	11.54%	13.46%	1.92%	19.23%	100.00%

Out of 52 patients, 24 (46%) were using the defecation method of straining/bearing down while others used different assisted defecation methods like digital ano-rectal stimulation (8%),suppositories (11%), digital evacuation (13%), mini enema (2%), large enema (19%) whose frequency of use significantly increased with the increasing duration of injury **(p=0.02)**

Table 5: Shows the Average time required for defecation of the spinal cord injury patients within the last four weeks.

Average time required for defecation (within the last four weeks)						
DURATION	**6-10 mins**	**11-20 mins**	**21-30 mins**	**31-60 mins**	**more than 60 mins**	**Total**
1to5year	2	13	3	3	0	21
	9.52%	61.90%	14.29%	14.29%	0.00%	100.00%
6to10year	0	7	4	6	4	21
	0.00%	33.33%	19.05%	28.57%	19.05%	100.00%
11to15year	0	0	0	5	1	6
	0.00%	0.00%	0.00%	83.33%	16.67%	100.00%
16to20year	0	0	1	1	2	4
	0.00%	0.00%	25.00%	25.00%	50.00%	100.00%
TOTAL	2	20	8	15	7	52
	3.85%	38.46%	15.38%	28.85%	13.46%	100.00%

The Average time required for defecation was also correlated with the duration since injury whose results were: 0-5mins duration was seen in none of the patients, 6-10 mins was seen in 3% patients, 11-20 mins was seen in 38% of patients,21-30 mins in 15% patients and 31-60 and more than 60 mins was seen in 29% and 14% patients respectively. The Average time required for defecation also significantly increased with the time duration since injury. **(p=0.009)**

DISCUSSION

Bowel function is a major problem for SCI patients. Patients have difficulties in bowel management similar to problems in mobility and sexual functions. Problems include delayed gastric emptying, abnormal gastric acid secretion and abnormal colonic myoenteric activity. Very few studies have been done to evaluate this problem related to the bowel functions after spinal cord

injury all over the world but none of them are being conducted in India till today. A personalized interview based questionnaire was felt as the most practical and approachable method for the assessment of bowel functions in spinal cord injury patients. In SCI including cord transection the GI reflex remains and defecation using this reflex is preserved. In this study cauda equine lesions are excluded because of different patho-physiology.

In previous studies, studying the factors affecting GI problems, Stone et al[14] and Gore et al [15] reported that the greater the severity of GI problems the higher the incidence. Gulati et al[16] reported that prevalence of bowel dysfunction was not related to neurological level of injury, and to whether or not this was complete. Stone et al[14] reported, however, that the prevalence of chronic GI problems increased with the time of injury suggesting that these problems were preventable, which also showed a similar research outcome as our findings.. Gulati et al[16] also pointed that their high incidence was maybe because of ineffective bowel habits and partly preventable. TR Han et al[17] reported that chronic GI problems and Bowel dysfunctions are not related to the severity of neurologic insult, duration of SCI and level of activity and most bowel habits had settled within six months.

CONCLUSION

Bowel programs are more assisted as the duration of injury progress, it may be because of ineffective use of bowel programs, or use of improper bowel programs which could result in more than average time required or lack of enough information about healthy dietary intake to avoid constipation.

So to improve bowel functions after SCI, a good enough education regarding bowel care like use of more of fiber diet and use of less fried and oily food is to be consumed. And during the rehabilitation process the patients must be able to understand the physiology of defecation and to use the proper defecation method required and he or she must also be taught to use that particular bowel program and defecation method effectively to avoid unnecessary complications and to avoid extra time taken to complete the bowel movement.

Ethical Clearance- Taken from Institutional Ethics committee Pacific Institute of Medical Sciences, Umarda, Udaipur, Rajasthan-313001

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Using the Modified Barthel Index to Estimate the Activity of Daily Living in Patients after Chronic Spinal Cord Injury in Northern Western Region of India

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ABSTRACT

The purpose of the study was to evaluate the Quality of life (QOL) using the Activities of Daily Living (ADL) score and it were studied using a structured questionnaire. The objective was to evaluate the effect of annual income and of the level of lesion on Activities of Daily Living (ADL) score after Spinal Cord Injury (SCI) patients. 52 SCI patients were interviewed individually. Results were statistically analyzed. The higher the annual income, the more was the ADL score and less dependency was seen in cervical spinal cord injury patients. Overall, all the SCI were severely dependant as per their ADL scoring.

Keywords: *Quality of life, Activites of Daily living, Spinal cord injury, annual income*

INTRODUCTION

Quality of life (QOL) is held to be the ultimate objective of rehabilitation[1,2] and a substantial body of research has sought to evaluate the QOL of survivors of spinal cord injury (SCI).[3,4] Over recent decades, medical advances in the care of people with spinal cord injury (SCI) have led to improved rates of survival and life expectancy.[5] In turn, emphasis has shifted from survival to life-long follow-up and quality of life (QOL). [6] Despite this change in focus, the degree to which people with SCI experience QOL that is equivalent to their able-bodied peers, and the predictors of that QOL remain underexplored.[7, 8, 9]

OBJECTIVES

- To assess the effect of annual income on ADL score after SCI.

- To assess the effect of level of lesion on ADL score after SCI.

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RESEARCH METHODOLOGY

Interview was performed individually on 52 spinal cord injury patients who were discharged from Research and Rehabilitation center, Sawai Mansingh Hospital Jaipur; the format was structured questionnaire[10].

Inclusion criteria:

Person after 1 year of Spinal Cord Injury & has given consent for study

Exclusion criteria:

Severely ill patients.

Collected data was entered and analyzed using MS-Excel version 2007. Quantitative data was presented as mean & standard deviation and qualitative data was presented as proportion. Their association was analyzed using Chi-Square Test and unpaired t-test.

Duration of the study

December 2017 to May 2018

RESULTS

52 spinal cord injury patients were selected for the study. Their demographic data is as follows:

Table 1: Shows the demographic data of the spinal cord injury patients.

Frequency		Percent
Age in years		
21-30	29	55.77%
31-40	19	36.55%
41-50	4	7.68%
Annual Income		
Nil/<1 lakh	22	42.30%
1-2 lakh	22	42.30%
>2 lakh	8	15.38%

Most of the spinal cord injury patients they come in the age group of 21-40 years (92%) only 4 patients were in the age group of 41-50years (8%). The Mean±SD of age of patients suffering from spinal cord injury is 30.56 ±6.34. Out of the patients interviewed 42% of the patients have no annual income while the remaining 42% of the patients were in the income group of 1-2lakh annually, only 15% of the patients had an income of more than 2lakh/year.

Table 2: Shows the level of injury of the spinal cord injury patients.

Frequency		Percentage
Level of Injury		
Cervical	8	15.38%
Dorsal-Lumbar	44	84.62%

Out of the patients interviewed predominant (84.62%) of the patients were suffering from Dorso-Lumbar Spinal Injury, while 15% patients were suffering from Cervical Spinal Injury.

Table 3: Shows the scoring and its likely interpretation according to the Modified Barthel Index[10]

Score	Interpretation
00 – 20	Total Dependence
21 – 60	Severe Dependence
61 – 90	Moderate Dependence
91 – 99	Slight Dependence
-100	Independence

Table 4: Shows the likely predictions of the patients who have come within the score range according to the Modified Barthel Index[10]

Score	Prediction
<40	Dependent in Mobility Dependent in Self Care
40-60	Pivotal score where patients move from dependency to assisted independence
60-80	If living alone will probably need a number of community services to cope
>85	Independent in transfers and able to walk or use wheelchair independently

Table 5: Shows the Mean ± SD of the Modified Barthel Index score of the patients[10]

Level of Injury	Mean ± SD	P value
Cervical	47.38±3.30	
Dorsal-Lumbar	20.18±2.30	<0.0001 (significant)
Total	23.63±9.85	

Table 6 : Shows the Mean ± SD Modified Barthel Index score of the patients differentiated on the basis of annual income.

Annual Income	Mean ± SD	P value
Nil/<1 lakh	21.27 ± 7.58	
>1 lakh	25.37 ± 11.04	0.009(significant)

DISCUSSION

Modified Barthel Index[11]: The MBI measures the individual's performance on 10 activities of daily living (ADL) functions in the area of self-care, continence, and locomotion; it measures the individual's performance of daily functions. (Activities in terms of the International Classification of Functioning, disability and health)[10]. The scale has been modified from the original BI[12] to increase the sensitivity to change of each item, most of all as to the quality and quantity of assistance.

According to the structured questionnaire of the Modified Barthel Index most of the patients included in our research are totally dependent on others for their routine day-to-day activities. Some of the patients are also severely dependent on others for the daily activities, though they can perform some activities under supervision.

The Modified Barthel Index score of the patients suffering from Cervical Spinal cord injuries was significantly better than that of the patients who had suffered from Dorso-Lumbar Spinal cord injuries. In the absence of studies to the contrary, it can neither be assumed that perceptions of ADL among those who have different levels of Injuries; nor that the factors contributing to ADL will be the same among all people with SCI, irrespective of their level of lesion. Siosteen et al[13] found using, modified Barthel Index scoring concluded that the QOL correlated with the severity of disability. Lin et al[14] found that QOL is not related to the level of Injury.

ADL was lower in those patients who did not have any regular and sufficient source of Annual Income than the patients who were in better economic conditions. The likely explanation could be that the affordability of the assistable devices for the use in outdoors (for e.g. electrical wheelchairs); house equipped with necessities. Given the paucity of studies exploring the life experiences of people with high SCI, rehabilitation therapists have little information with which to ensure the relevance and usefulness of their interventions. The purpose of rehabilitation is to achieve a high level of independence in self-care[15]

QOL for people with SCI was found to be lower than for their able-bodied peers, confirming the need to more effectively address QOL as a goal for hospital and community rehabilitation services.[16]

CONCLUSION

Although there was some degree of independence is seen in cervical spinal cord injury patients almost all patients have severe degree of dependence irrespective of level of injury.

ADL score is towards the lower side in patients with no/very low annual income. So it is recommended to provide all SCI patients, a better kind of rehabilitation program as early as possible at no costs and that program must not only include physical rehabilitation but it should also be able to provide them some sort of employment and so they can get some of their self confidence, including some degree of financial support. Rehabilitation services must employ improved methods to address the most common and most disabling secondary conditions.

As the expenses are heavy for running a life after SCI, so the government must take an extra initiative in taking care of SCI patients either by increasing their disability pension or bearing some of their expanses as like of wheelchair and medicines.

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Role of Glycemic Control on Diabetic Retinopathy and Microalbuminuria in Type II Diabetics

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ABSTRACT

Background & Objective:- Uncontrolled hyperglycemia has been recognized to be associated with higher incidence of microvascular complications like retinopathy and nephropathy in Type II diabetes mellitus. This study aimed to find the effect of glycemic control on the presence of retinopathy and microalbuminuria in Type II diabetics and the relationship between microalbuminuria and retinopathy.

Materials & Mehod:- The study group comprised of 60 Type II diabetes mellitus patients within the age group of 40-60 years. They were further divided into two subgroups:- group 1 (n=30) $HbA_{1c}<7\%$-Controlled Diabetic Group, group 2 (n=30) $HbA_{1c}>7\%$-Uncontrolled Diabetic Group and 30 age-matched normal individuals, used as the Control Group, $HbA_{1c}<6\%$.

After thorough examination of the subjects the following tests were done in study and control groups:- 1) Glycosylated Hemoglobin, 2) Microalbuminuria and 3) Retinopathy was detected and graded with the help of ophthalmologist.

Statistics:- The results obtained were treated statistically by One-way ANOVA and chi-square test between the groups.

Results:- Uncontrolled diabetics with poor glycemic control ($HbA_{1c}>7\%$) showed higher incidence of microalbuminuria (53.33%) & retinopathy (43.33%) when compared to controlled diabetics [microalbuminuria (23.33%) & retinopathy (10%)] with good glycemic control ($HbA_{1c}<7\%$). There was a significant association of retinopathy with microalbuminuria (p<0.05).

Conclusion:- Uncontrolled hyperglycemia is associated with higher incidence of microvascular complications like retinopathy and nephropathy in diabetes. Microalbuminuria is associated with diabetic retinopathy in Type II diabetic patients and is a reliable predictor of retinopathy. Diabetic patients who have microalbuminuria should be under periodic ophthalmological surveillance for prevention of retinopathy by stringent glycemic control.

Keywords:- *Glycemic control, retinopathy, microalbuminuria.*

INTRODUCTION

Microvascular complications are the major cause of morbidity and mortality in persons with Type II

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DM. Chronic hyperglycemia is a major initiator of microvascular complications including nephropathy, retinopathy and neuropathy. These complications are predominantly seen in patients in the age group of 40 to 60 years. Poor glycemic control plays an important role in the development and progression of retinopathy and nephropathy with associated increase in morbidity and mortality[1]. Several studies in this field have suggested a strong association between level of hyperglycemia

and the progression of microvascular complications in diabetic patients[2]. Strong evidence exists that improved glycemic control is effective at lessening the risks of retinopathy, nephropathy and neuropathy in diabetes[3].

Diabetes is one of the leading causes of blindness in the industrialized countries[4,5] where the chances of loosing the sight are about 25 times higher than normal population. This microvascular complication is predominantly seen in the age group of 40 to 60 years and is decreased by reduction of blood glucose concentrations[6].

Microalbuminuria, defined as an elevation of urinary albumin excretion in the range of 30-300 mg/24hr or 20-200 µg/min, is associated with adverse health outcomes in adults[7]. One of the earliest signs of diabetic nephropathy is microalbuminuria which is strongly associated with endothelial dysfunction, which increases the risk of nephropathy and other complications in diabetes and microalbuminuria is the best documented predictor of diabetic nephropathy[8], which is a major cause of end stage renal disease (ESRD)[9]. Studies of patients with diabetes have shown that those with microalbuminuria are at increased risk for renal progression[10,11] and excess morbidity and mortality[12,13].

AIM OF THE STUDY

The present study aimed at evaluating the relationship between diabetic retinopathy and diabetic nephropathy[microalbuminuria] in type2 diabetes mellitus and glycemic control as estimated by glycated hemoglobin level in the rural population in and around Kolar.

MATERIALS & METHOD

The study is conducted in a group of 90 individuals consisting of 30 normal healthy subjects as control and 60 diagnosed cases of Type II Diabetes Mellitus, irrespective of duration of diabetes and sex taken randomly from the outpatient and admitted patients at Sri Devaraj Urs Medical College (SDUMC), Kolar. The Diabetes mellitus patients were further divided into two sub-groups each consisting of 30 patients: Type II Diabetes mellitus patients with good glycemic control (HbA1c < 7%) in Group 1 - controlled diabetics and Type II Diabetes mellitus patients with poor glycemic control (HbA1c > 7%) in Group 2 – uncontrolled diabetics.

The Research and Ethical committee of SDUMC has approved this study and Informed consent was obtained from all patients and control subjects participating in this study.

Exclusion criteria:- Subjects suffering from hypertension, renal disease and persons on drugs affecting retina like chloroquine, thioridozine, chlorpromazine etc were excluded from this study. Patients on medications altering renal function like ACE-Inhibitors (Angiotensin converting enzyme inhibitors), ARB (Angiotensin receptor blockers), diuretics and NSAID were excluded from this study. Personal history of smoking & alcohol consumption were also excluded.

Taking all aseptic and antiseptic precautions, 3 ml of blood is drawn from the Ante cubital vein and 24 hrs urine sample is collected in a sterilized container for estimation of HbA_{1c} and microalbuminuria respectively. Glycosylated hemoglobin level was estimated by cation-exchange resin method (Recombigen laboratories pvt. Ltd kits) using a Spectrophotometer. Microalbuminuria was detected by Micral test (Roche Diagnostics Ltd), a dipstick method in urine and Retinopathy was detected/ruled out with the help of an ophthalmologist using direct and indirect ophthalmoscopy, three mirror slit lamp fundoscopy and classified as Non-proliferative, Proliferative according to ETDRS[14].

The prestigious Early Treatment Diabetic Retinopathy Study (ETDRS) research group has classified diabetic retinopathy into the following:-

Nonproliferative diabetic retinopathy(NPDR):

Mild NPDR	Microaneurysms only
Moderate NPDR	More than just microaneurysms but less than severe NPDR
Severe NPDR	Any of the following:
	* >20 intraretinal hemorrhages in each of 4 quadrants
	* Definite venous beading in 2+ quadrants
	* Prominent intraretinal microvascular abnormalities in 1+ quadrant
	* And no signs of proliferative retinopathy.

Proliferative diabetic retinopathy(PDR): One or more of the following:

* Neovascularisation

* Vitreous/preretinal hemorrhage.

FINDINGS

Mean age of controlled diabetic group (n=30) is 51.83±5.86yrs, uncontrolled diabetic group (n=30) is 56.17±4.18yrs and mean age group of control group (n=30) is 53.03±6.26yrs. Mean HbA_{1c} levels between the three groups are shown in Table No. 1 which shows an elevated level of HbA_{1c} in uncontrolled diabetic group compared to controlled diabetic group and Control group which is statistically significant.

Microalbuminuria and retinopathy was not noticed in any subjects of the control group. 7 out of 30(23.33%) microalbuminuria positive subjects were present in controlled diabetic group (n=7). 16 out of 30(53.33%) microalbuminuria positive subjects were present in uncontrolled diabetic group(n=16). 3 retinopathy(NPDR) positive subjects were present in controlled diabetic group(n=3) 10%, PDR was not noticed in any subjects of the controlled diabetic group.10 retinopathy(NPDR) positive subjects were present in uncontrolled diabetic group(n=10) 33.33%, PDR was present in 3 subjects of the uncontrolled diabetic group(n=3) 10%. Overall retinopathy was present in 13 subjects of the uncontrolled diabetic group(n=13) 43.33% (Table No. 2 refers).

Occurrence of microalbuminuria between controlled diabetic and uncontrolled diabetic group was statistically not significant (p>0.05 NS). However the occurrence of retinopathy in uncontrolled diabetic group was significantly higher as compared to controlled diabetic group (p<0.02) (Table No. 3 refers).

On comparison of occurrence of retinopathy in subjects with microalbuminuria (controlled diabetic and uncontrolled diabetic groups) and subjects without microalbuminuria (controlled diabetic and uncontrolled diabetic group), the subjects with microalbuminuria showed significantly higher occurrence of retinopathy as compared to subjects without microalbuminuria (p<0.05) (Table No. 4 refers).

None of the subjects of controlled diabetic group showed PDR. PDR was seen in 3 cases in uncontrolled diabetic group and all had HbA_{1c} values above 8.48%.

Table No.1: Comparison of HbA_{1c} levels between control group, controlled diabetic and uncontrolled diabetic group using one-way ANOVA:

GROUPS	HbA_{1c} Value% mean±sd	MS Effect	MS Error	df Error	F	p Value
Control (n=30)	5.75±0.24	39.91	0.32	58	123.08	<0.001
Controlled Diabetics (n=30)	6.45±0.37					
Uncontrolled Diabetics (n=30)	8.01±0.83					

Table No. 2: Percentage distribution of microalbuminuria and retinopathy in control group, controlled diabetic and uncontrolled diabetic group:

GROUPS	% occurrence of Microalbuminuria	% occurrence of Retinopathy		
		NPDR	PDR	TOTAL
Control (n=30)	0	0	0	0
Controlled Diabetics (n=30)	23.33 (n=7)	10 (n=3)	0	10 (n=3)
Uncontrolled Diabetics (n=30)	53.33 (n=16)	33.33 (n=10)	10 (n=3)	43.33 (n=13)

Table No. 3: Comparison of occurrence of microalbuminuria & retinopathy in controlled diabetic vs uncontrolled diabetic group using Chi-square test:

GROUPS	Microalbuminuria Frequency	χ^2	p Value	Retinopathy Frequency	χ^2	p Value
Controlled Diabetics (n=30)	7	3.52	>0.05	3	6.25	<0.02
Uncontrolled Diabetics (n=30)	16			13		

Table No. 4: Comparison of occurrence of retinopathy in subjects with microalbuminuria and without microalbuminuria using Chi-square test:

GROUPS	Retinopathy Frequency	χ^2	p Value
Subjects with microalbuminuria (n=23) n = 23 (n=23)	12	4	<0.05
Subjects without microalbuminuria (n=37)	4		

Table No. 5: HbA$_{1c}$ levels and percentage distribution among subjects with microalbuminuria and subjects with retinopathy:

GROUPS	HbA$_{1c}$ Value% (mean±sd)	Percentage
Subjects with microalbuminuria (n=23)	7.96±1.05	38.33%
Subjects with retinopathy (n=16)	8.30±1.06	26.67%

DISCUSSION

In our study microalbuminuria was present in a total of 23 subjects drawn both from controlled diabetics & uncontrolled diabetic groups; this represented a 38.33% rate of occurrence in the diabetic population. Various studies have reported the prevalence of microalbuminuria ranging from 25% to 35%[15 - 18]. The slightly higher percentage of microalbuminuria in our study can be attributed to poor glycemic control(mean HbA$_{1c}$ 7.96±1.05%) [Table No. 5].

Higher levels of HbA$_{1c}$ are known to be associated with increasing incidence of microalbuminuria. In our study 7 out of 30 patients of controlled diabetic group with mean HbA$_{1c}$ of 6.45±0.37% manifested microalbuminuria whereas 16 out of 30 patients of uncontrolled diabetic group with mean HbA$_{1c}$ of 8.01±0.83% had microalbuminuria. It is seen from the above result that even small increments of HbA$_{1c}$ result in almost doubling of the incidence of microalbuminuria.

In our study retinopathy was present in 16 subjects(26.67%) (both controlled diabetics & uncontrolled diabetics) [Table No. 5]. Numerous earlier studies reported incidence of retinopathy in Type II diabetes between 16 to 53.4%[19 - 23]. Our study showed the prevalence rate of 26.67% which is somewhere in median range. It is thus in agreement with most of the earlier reports.

In our study out of 60 cases, 37 were normoalbuminuric (subjects without microalbuminuria). Out of these 4 subjects exhibited retinopathy. There were 23 subjects with microalbuminuria, out of which 12 had retinopathy. This shows that most of the patients with retinopthy had microalbuminuria, while only a small fraction of normoalbuminuric subjects presented with retinopathy. Statistically also, the occurrence of retinopathy in patients with microalbuminuria was significantly higher than normoalbuminuric subjects (p<0.05, Table No. 4). This observation coincides with findings of other studies[24]. These findings suggest that presence of microalbuminuria is a strong predisposing factor for the development of retinopathy.

In a study of correlation between microalbuminuria and diabetic retinopathy, the prevalence of retinopathy was higher in microalbuminuria patients ie 76% when compared to normoalbuminuric patients ie 38.6%[25]. Erasmus et al (1992) have shown that in 113 patients suffering from NIDDM, the incidence rate of microalbuminuria was as high as 54% among males

and 59% among females. Prevalence of retinopathy and hypertension was 16% and 41% respectively. They concluded that microalbuminuria may not predict retinopathy and occurs independently from either glycemic control or elevated blood pressure levels[26]. The results of our study are not in corroboration of their findings.

From the foregoing, it is logical to conclude that microalbuminuria and retinopathy coexist in a majority of patients with uncontrolled diabetes.

CONCLUSION

Uncontrolled diabetics showed a higher occurrence of microalbuminuria as compared to the control group as well as diabetics with good long term glycemic control. The incidence of retinopathy was significantly higher in uncontrolled diabetics as compared to both control and controlled diabetic group. Microalbuminuria is a marker of risk for retinopathy development. Microalbuminuria and retinopathy showed a direct relationship with glycemic control. HbA_{1c} value above 7% is associated with higher occurrence of microalbuminuria and retinopathy. Diabetic patients who have microalbuminuria may benefit from close ophthalmologic follow up. Microalbuminuria serves as a warning to achieve good glycemic control and prevent further worsening of diabetes related complications like retinopathy.

Conflict of Interest – Nil

Source of Funding – None

Ethical Clearance - The Research and Ethical committee of SDUMC has approved this study and Informed consent was obtained from all patients and control subjects participating in this study.

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